FAA WILLIAM J. HUGHES TECHNICAL CENTER
TEST AND EVALUATION HANDBOOK

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

This handbook provides standard processes for conducting high quality and consistent Test and Evaluation (T&E) that supports the mission of Verification and Validation (V&V). The use of this handbook by all T&E organizations at the Federal Aviation Administration (FAA) William J. Hughes Technical Center (WJHTC) is required by the FAA order titled "FAA William J. Hughes Technical Center's Test and Evaluation Policy".

1.1 VERIFICATION AND VALIDATION PRINCIPLES

As part of the FAA mission, the WJHTC is actively engaged in applying effective V&V principles and practices to T&E efforts. The intent of this initiative is to improve the quality of T&E products and services, promoting effective planning, reducing risks, and decreasing costs.

This initiative addresses the standards for V&V process areas that are based on the Capability Maturity Model® Integration (CMMI®) standards, published by the Software Engineering Institute of Carnegie Mellon University.

In accordance with CMMI®, the purpose of verification is to ensure that a system is built right, while validation ensures that the right system is built. Verification and validation represent complementary process areas that are distinguished below.

- **Verification** - Confirmation that selected work products meet their specified requirements. This includes verification of the end product (system, service or operational change) and intermediate work products against all applicable requirements. Verification is inherently an incremental process since it occurs throughout the development lifecycle of the work products, beginning with initial requirements, progressing through subsequent changes, and culminating in verification of the completed end product.
- **Validation** - Confirmation that an end product or end product component will fulfill its intended purpose when placed in its intended environment. The methods employed to accomplish validation are applied to selected work products as well as to the end product and end product components. The work products should be selected on the basis of which are the best predictors of how well the end product and end product component will satisfy the intended purpose and user needs. Validation can apply to all aspects of an end product in any of its intended environments, such as operation, training, manufacturing, maintenance or support services.

V&V is a disciplined approach to assessing a product throughout the product lifecycle. V&V strives to ensure that quality is built into the product and that the product satisfies operational requirements. A strong focus on validation, an industry best practice, also helps to ensure customer satisfaction. The T&E standards defined in this handbook support a significant portion of a comprehensive V&V approach. Some CMMI® V&V practices are executed outside of the T&E function such as those that apply to the systems engineering discipline and are therefore not addressed in this document. The relationship of how the T&E function applies to V&V is depicted in Figure 1-1, T&E Application to the V-Model. The V-Model illustrates the interactions between each phase of the acquisition lifecycle and its associated T&E phase (i.e., T&E Planning and Support, Development Test (DT), and Operational Test (OT)).

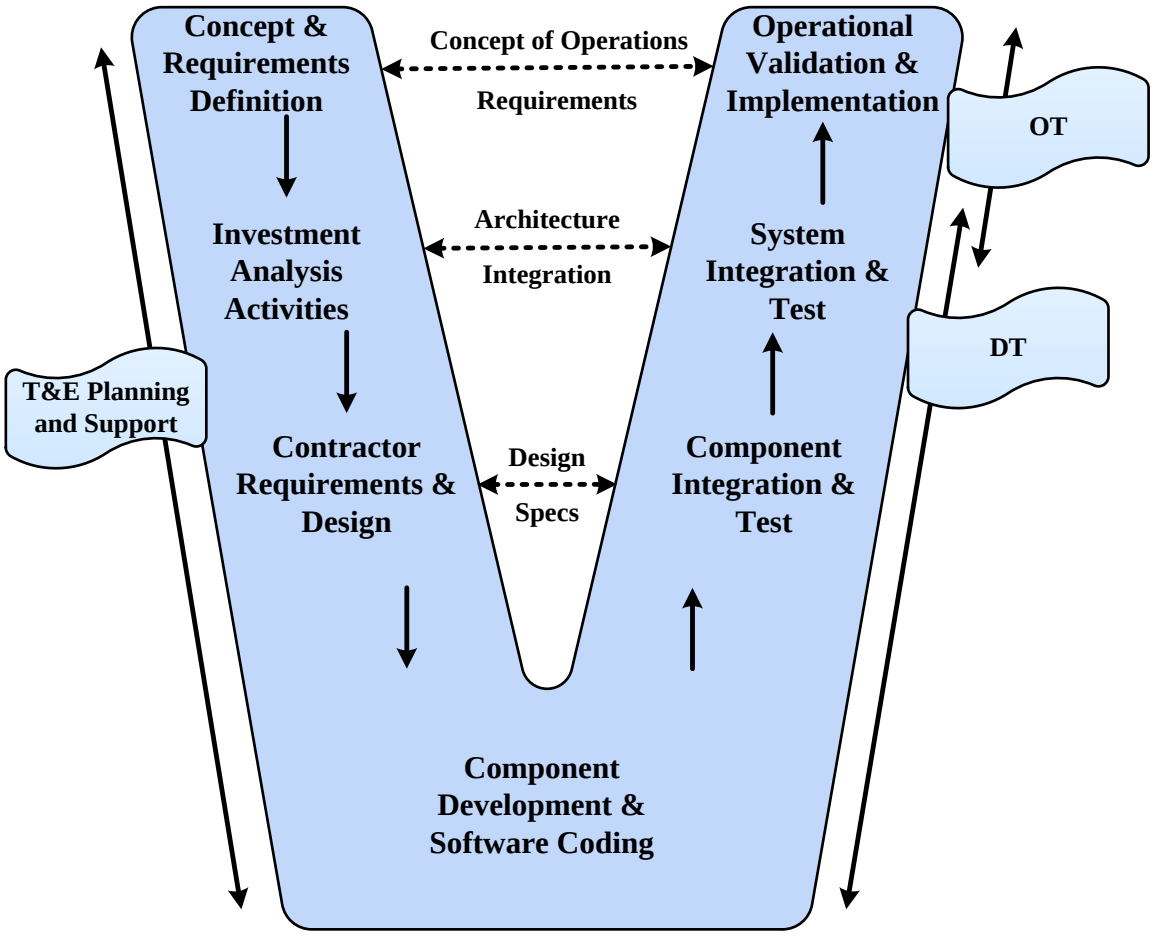

FIGURE 1-1. T&E APPLICATION TO THE V-MODEL

The large shaded "V" represents the concept that both Verification and Validation are performed throughout a system or service acquisition, from concepts and requirements definition through implementation/operational system validation. V&V is performed in varying degrees on a continuous basis by many entities involved in the acquisition. For instance, System Engineering has a primary role in the V&V of requirements and concepts, while the T&E organization has an equivalent role in the V&V of the integration and test of the system or service.

Within the context of V&V, T&E practitioners play a critical role in the acquisition process. As depicted in the diagram, the arrows on the outside of the diagram depict the phases of T&E described in this handbook. The arrow on the left side of the "V" represents the T&E Planning and Support phase. The primary V&V role of T&E during this phase is to support the development of concepts, requirements, and design. The arrows on the right side of the "V" represent the DT and OT phases. The primary V&V role during these two phases is the conduct of T&E itself.

The arrows in the middle of the "V" are intended to show that each side of the "V" feeds the other. For instance, concepts and requirements definition drives the test cases for OT, while OT development and conduct can feed back for future concepts and requirements definition.

1.2 OBJECTIVES OF THE TEST AND EVALUATION HANDBOOK

This handbook describes the test and evaluation processes, methods, and standards. The objective is to ensure that a test program is complete, well managed, and conducted in a consistent manner by the program test team throughout a system's lifecycle, as well as achieving V&V objectives. (The use of the word "system" within this handbook refers to the "system" or "service" that the FAA is acquiring.) The processes delineated in this handbook may be tailored to meet the specific needs of a given FAA acquisition program and are described in Section 1.6.

This handbook is based on the Acquisition Management System (AMS) T&E Process Guidelines and the FAA AMS Policy. Preparation of the handbook was guided by lessons learned from past test programs, industry best practices, future ANG-E T&E needs, International Organization for Standardization (ISO) and CMMI® standards.

1.3 SCOPE

This handbook addresses the ANG-E T&E preparation, planning, conduct, and reporting activities in support of all FAA ANG-E programs. It is intended for use by all test personnel. This handbook is organized into sections that first provide an overview of the T&E preparation and support activities throughout the AMS lifecycle phases, and then define the specific T&E support required for each phase.

This handbook describes the processes associated with the AMS T&E Work Breakdown Structure (WBS) that support the objectives of the V&V process areas. The AMS defines the T&E WBS as follows:

> Test and Evaluation (AMS WBS, 3.5) - All activities associated with testing, analyzing, and evaluating in order to verify and validate that products meet specifications, satisfy requirements, and are operationally suitable and effective.

References are made throughout the handbook to the "V&V Repository." The V&V Repository is an Internet-based information source hosted on servers under FAA control. The repository provides users of this handbook with T&E templates, samples, and tools as standard guidance to accomplish specific V&V practices. The V&V Repository is located within the ANG-E T&E Portal on the Knowledge Services Network (KSN) site.

1.4 ROLES AND RESPONSIBILITIES

In conjunction with this handbook, the WJHTC Test Roles and Responsibilities Guide (TRRG) provide roles and responsibilities for the ANG-E test personnel as well as supporting T&E roles. The TRRG also includes T&E management and test team structures.

The Test Standards Board (TSB) is responsible for updating and managing this handbook in accordance with the TRRG. The TRRG defines the organizational roles, responsibilities, TSB processes, and management processes for administering and managing the ANG-E T&E standards and practices.

Note: Refer to the V&V Repository for the Test Roles and Responsibilities Guide (TRRG).

1.5 FUNDAMENTAL PRACTICES FOR QUALITY T&E

All T&E programs must implement the following set of fundamental practices to ensure a quality T&E program. The fundamental T&E practices are as follows:

a) T&E services are involved in all lifecycle phases of the program to support and plan for the verification and validation of major work products, product components and products.

b) T&E activities are systematic and progressive in that they build in complexity by first focusing on basic components and then stepping up to progressively more complex and integrated testing.

c) Every T&E event has a lead(s) who is responsible for:

   1) Conduct of activities

   2) Overall quality of testing

   3) Accepting the results

   4) Reporting the results

d) T&E activities that support acceptance of work products or approval of program milestones are well defined and tracked.

e) An integrated test plan (e.g., Test and Evaluation Master Plan (TEMP), see Section 5.3) is developed and completed early in the program and routinely updated to reflect the evolution of the program.

f) Prior to requirements approval, T&E services participate in reviews to ensure that all program requirements are testable and validated against the operational mission.

g) T&E is involved in the development of the procurement package to ensure that the contract complies with the test strategy and scope documented in acquisition planning and test strategy documents.

h) T&E practices must include:

   1) Test teams that have the knowledge, skills, and training for testing the products under test

   2) Documented Test Plans, Procedures, and Reports that are comprehensive, clear, concise, written in plain language, and peer-reviewed

   3) A stable, accredited and configuration managed test environment and tools that enable the test cases to meet the documented test objectives without numerous or significant deviations

   4) A complete end-to-end dry run of procedures prior to the formal or final execution of procedures

   5) Accurately documented as-run test procedures and test logs for dry runs and formal test runs

6) Reports that provide historical test data, results, risks, deficiencies, and recommendations with clear analysis of the performance and limitations against planned objectives and requirements

7) Regression testing that is conducted to verify and validate that fixes and modifications do not adversely affect other interrelated operations and functionality

i) Operational Testing is executed in a test environment (hardware, software, interfaces, etc.) representative of the expected in-service operational conditions. Operational Testing is conducted with a representative team of end users who are expected to interface with or operate the product under test.

j) Required modifications for defects are verified and validated under conditions equivalent to those that existed when the defects were initially identified.

1.6 TAILORING OF T&E PROCESSES

Every T&E program is unique and has its own set of challenges and differences. Tailoring is a critical activity that allows controlled changes to processes to meet the specific needs of a project or organization.

1.6.1 TAILORING CRITERIA AND PROCESSES

To meet the unique needs of a program, the T&E processes in this handbook may be tailored based on:

a) Program complexity/scope

b) Risks

c) Size of the acquisition

d) Acquisition strategies and type (e.g., Commercial Off-the-Shelf (COTS), Services, Software, Hardware, procurement of systems or equipment, modification of facilities, changes in the physical infrastructure, development of functional interfaces, spiral development implementation, etc.)

e) Program scope changes and decisions approved by the Joint Resources Council (JRC)

f) Test strategies in the approved TEMP.

T&E processes and process elements that are directly related to critical standards and process objectives and that have the word "must" in the Process Description Document (PDD) should not be tailored without a valid programmatic or technical justification. Processes defined in this handbook that have been changed or omitted in a program require a clear rationale that relates to a specific unique program element or technical variable (e.g., Integration Testing may not be required on non-complex systems). The Fundamental T&E Practices defined in Section 1.5 must be evident and remain intact in any tailored or developed process.

The tailored program processes are documented and approved in the Process Conformance Checklists as defined in Section 1.7. The TSB reviews and assesses the tailoring approach and rationale documented in the compliance checklists and determines if the T&E handbook processes and fundamental practices for quality T&E are maintained. If the checklists are adequate, they are signed by the TSB. Any major deviations from test standards must be

rationalized, documented, and approved in a Request for Waiver form. This request is initiated by the Test Director or T&E First Line Supervisor. The Quality Management Lead will identify the approval authority.

Note: Refer to the V&V Repository for the Request for Waiver form.

1.6.2 TAILORING GUIDELINES

1.6.2.1 TYPES OF TAILORING

Tailoring of T&E processes can involve the following types of adjustments to processes:

a) Change in formality

b) Change in frequency

c) Change in format

d) Modifying a process

e) Eliminating a process

f) Combining processes

g) Renaming a process

h) Changing or consolidating process roles and responsibilities

i) Changing the order of processes

1.6.2.2 COMMONLY TAILORED PROCESSES

Candidate T&E processes in this handbook that are commonly tailored for a test program consist of, but are not limited, to the following major processes (as defined in Sections 6 and 7):

a) DT test activities

b) Required DT contractor documents

c) DT problem reporting

d) OT Interim Assessments Reports

e) Logistics for formal OT test conduct support

f) Field Familiarization Support

1.7 T&E STANDARDS CONFORMANCE PROCESS

The T&E standards conformance process is used to monitor conformance to the T&E processes specified in this handbook and to provide supporting artifacts (conformance checklists) for quality audits. This process will support the identification of required actions to resolve non-conformance issues. This process also identifies the specific approach that the Test Director plans to take to address required standards.

At the onset of T&E test team involvement in a test program, the DT and OT Test Directors must prepare and submit the initial version of the Test Planning Process Conformance Checklist to the T&E First Line Supervisor and TSB for review and approval. Prior to submission, the DT and OT Test Directors must jointly review the Test Planning Process Conformance Checklist to

determine which test process items, if any, need to be tailored. In a similar fashion, the DT and OT Test Directors must review their respective DT or OT Process Conformance Checklists. As a part of the reviews, the DT and OT Test Directors must document the tailored processes and rationale in the checklists accordingly. The initial version of the DT and OT Process Conformance Checklists must be prepared immediately after the program Initial Investment Decision has been made.

Each of the three Process Conformance Checklists must be maintained by the appropriate Test Director throughout the respective T&E phases of the program to document the test team's progress in and conformance to the T&E process. Any additional tailoring of the approved test process items must be noted in the revised checklist and approved by the T&E First Line Supervisor and the TSB. Additionally, with one week prior notification to the T&E First Line Supervisor, the TSB will periodically review each test program's Process Conformance Checklists against work products and progress.

Appendices A through C of this handbook contain the Test Planning, DT, and OT Process Conformance Checklists, respectively. These checklists delineate the test process items derived from this handbook. The checklists contain a column that allows for documenting tailored test process items. The checklists also have columns for documenting status, comments, and any associated artifacts.

Note: Refer to the V&V Repository for the Test Planning, DT, and OT Process Conformance Checklist templates.

1.8 T&E QUALITY MANAGEMENT SYSTEM PROCESSES

The T&E Quality Management System (QMS) processes address practices that are necessary for providing quality T&E services. These QMS processes support and enable the implementation and execution of the standards and processes defined in this handbook. Test personnel are required to follow these processes in order to be compliant with the policy defined in the FAA order titled "FAA William J. Hughes Technical Center's Test and Evaluation Policy". The QMS processes are documented as Process Description Documents (PDDs) and are located in the V&V Repository. Each PDD is defined below.

a) Project Management (PM) – provides a process to manage FAA WJHTC organization T&E projects.
b) Quality Assurance (QA) – provides processes for QA audit activities in support of the T&E goals, and provides management with insight on the level of adherence to applicable standards.
c) Configuration Management (CM) – provides CM processes performed by practitioners in support of T&E related services to ensure that Configuration Items (CIs) are managed and controlled.
d) Document Management and Control (DMC) – provides processes to manage and control T&E and Quality Management System (QMS) documents.
e) Peer Review – provides a process to improve the quality of T&E work products and to help verify that work products meet requirements.

f) Calibration – provides a process to define the requirements for the calibration of test, measurement and diagnostic equipment, diagnostic software, and test data sets.
g) Corrective and Preventive Action – provides a process to identify and correct the cause(s) of nonconformities and/or potential nonconformities in products and processes within the T&E organization.
h) Control of Records – provides a process for identification, collection, maintenance, protection, and storage of records.
i) Customer Feedback – provides a process to describe how the T&E organizations receive and process feedback from customers.
j) Management Review – provides a process by which the T&E organizations review the QMS to ensure that it is suitable, adequate, and effective in meeting customer requirements.
k) Nonconforming Material – provides a process for identifying, reporting, segregating, controlling and processing nonconforming test equipment, software, and custom test setups, to prevent unauthorized use during formal testing.
l) Special Support Activities – provides a process describing how the T&E organizations handle special projects, studies, or provide subject matter expertise based upon the customer's needs.
m) Quality Manual – provides a reference of processes to ensure quality testing of systems and services entering into the National Airspace System (NAS).

1.9 PEER REVIEWS

Peer reviews are a critical component of V&V for T&E work products generated throughout a product's AMS lifecycle. Peer reviews are an effective verification practice for the early removal of defects from selected work products and are the first mechanism for verification prior to having partially or fully assembled product components.

Peer reviews involve a methodical examination of work products by the producer's peers as a quality check to identify defects and to recommend changes or improvements. Peer reviews provide strategic technical, operational, and procedural input for specific work products. The peer review process must be conducted in accordance with the T&E Peer Review Process Description Document (PDD).

Note: Refer to the V&V Repository for the T&E Peer Review PDD standard.

Depending on the complexity, impact, and size of the work product, a peer review can involve a large group of peers or a single peer. The peer review process is to be applied, at a minimum, to the following T&E work products:

a) T&E section of the Program Requirements Document (PRD)
b) T&E input to the Implementation Strategy and Planning Document (ISPD)
c) TEMP
d) T&E input to the FAA System Specification

e) T&E input to the Screening Information Request (SIR) proposal requirements

f) T&E input to the Statement of Work (SOW)/Performance Work Statement (PWS)/Statement of Objectives (SOO)

g) OT Test Plan

h) OT Test Procedures

i) OT Final Test Report

j) OT Test Capability Accreditation Plan and Report

k) Field Familiarization Support Plan

Peer reviews for the above work products should be completed prior to the final TSB review. See Appendix D for the recommended sequence of the peer review for the specific work product.

For contract deliverables (e.g., the Contractor Master Test Plan (CMTP), DT Test Plans, DT Test Procedures, and DT Test Reports), the DT test team should be provided with a documented record by the contractor confirming that the deliverables have undergone internal peer reviews prior to FAA review and approval (see Section 6.1.3.2).

2 RELATED DOCUMENTS AND REFERENCES

a) *Capability Maturity Model Integration® (CMMI®) for Development, Version 1.2,* Carnegie Mellon Software Engineering Institute, Pittsburgh, PA, August 2006.

b) *CMMI® for Acquisitions, Version 1.2,* Carnegie Mellon Software Engineering Institute, Pittsburgh, PA, November 2007.

c) *FAA Acquisition System Toolset, Acquisition Management Policy*, FAA Acquisition Management System, Washington, DC.

d) *FAA Acquisition System Toolset, In-Service Review Checklist*, FAA Acquisition Management System, Washington, DC.

e) *FAA Acquisition System Toolset, Test and Evaluation Process Flowchart*, FAA Acquisition Management System, Washington, DC.

f) *FAA Acquisition System Toolset, Test and Evaluation Process Guidelines,* FAA Acquisition Management System, Washington, DC.

g) *FAA AMS Lifecycle Verification and Validation Guidelines,* FAA Acquisition Management System, Washington, DC.

h) *FAA NAS System Engineering Manual,* Air Traffic Organization Operations Planning, Washington, DC.

i) *FAA Order 1800.66, Configuration Management Policy with Changes 1 and 2*, Washington, DC.

j) *FAA Order 6032.1B, National Airspace System Modification Program*, Washington, DC.

k) *FAA Test and Evaluation Gold Standard and Implementation Guide,* Washington, DC.

l) *Order CT 1810.8 or replacement, FAA William J. Hughes Technical Center's Test and Evaluation Policy*, FAA William J. Hughes Technical Center, Atlantic City International Airport, NJ.

m) *T&E Document Management and Control Process Description Document (TSPAT-B2-PDD-001),* FAA William J. Hughes Technical Center, Atlantic City International Airport, NJ.

n) *T&E Calibration Process Description Document (TSPAT-B2-PDD-009),* FAA William J. Hughes Technical Center, Atlantic City International Airport, NJ.

o) *T&E Configuration Management Process Description Document (TSPAT-B2-PDD-002),* FAA William J. Hughes Technical Center, Atlantic City International Airport, NJ.

p) *T&E Control of Records Process Description Document (TSPAT-B2-PDD-006),* FAA William J. Hughes Technical Center, Atlantic City International Airport, NJ.

q) *T&E Corrective and Preventive Action Process Description Document (TSPAT-B2-PDD-004),* FAA William J. Hughes Technical Center, Atlantic City International Airport, NJ.

r) *T&E Customer Feedback Process Description Document (TSPAT-B2-PDD-008),* FAA William J. Hughes Technical Center, Atlantic City International Airport, NJ.

s) *T&E Management Review Process Description Document (TSPAT-B2-PDD-005),* FAA William J. Hughes Technical Center, Atlantic City International Airport, NJ.

t) *T&E Nonconforming Material Process Description Document (TSPAT-B2-PDD-007),* FAA William J. Hughes Technical Center, Atlantic City International Airport, NJ.

u) *T&E Peer Review Process Description Document (TSPAT-B2-PDD-011),* FAA William J. Hughes Technical Center, Atlantic City International Airport, NJ.

v) *T&E Project Management Process Description Document (TSPAT-B2-PDD-010),* FAA William J. Hughes Technical Center, Atlantic City International Airport, NJ.

w) *T&E Quality Assurance Process Description Document (TSPAT-B2-PDD-003),* FAA William J. Hughes Technical Center, Atlantic City International Airport, NJ.

x) *T&E Quality Manual (TSPAT-B2-PLY-002),* FAA William J. Hughes Technical Center, Atlantic City International Airport, NJ.

y) *T&E Special Support Activities Process Description Document (TSPAT-B2-PDD-013),* FAA William J. Hughes Technical Center, Atlantic City International Airport, NJ.

z) *Test Roles and Responsibilities Guide,* FAA William J. Hughes Technical Center, Atlantic City International Airport, NJ.

3 T&E SUPPORT ACROSS THE AMS LIFECYCLE

The FAA AMS program lifecycle phases are summarized below:

a) Service Analysis & Strategic Planning and Concept & Requirements Definition (CRD) - Service Analysis & Strategic Planning and CRD begin with the identification of new FAA service needs. It provides a basis for long-range strategic planning and is defined as follows:

   1) Service Analysis & Strategic Planning – Service Analysis & Strategic Planning is the process used to determine what capabilities must be in place now and in the future to meet agency goals and the service needs of customers. Results are captured in the "as is" and "to be" states of the enterprise architecture, as well as the roadmaps for moving from the current state to the future state.

   2) Concept & Requirements Definition (CRD) – CRD translates priority operational needs into preliminary requirements and a solution concept of operations for the capability needed to improve service delivery. It quantifies the service shortfall in sufficient detail for the definition of realistic preliminary requirements and the estimation of potential costs and benefits. Finally, CRD identifies the most promising alternative solutions able to satisfy the service need.

   3) In addition to the activities defined above, research projects often support and provide information to this first phase of the AMS lifecycle.

b) Investment Analysis (IA) - IA begins after the completion of CRD with the Investment Analysis Readiness Decision (IARD). IA is the process used to support capital investment decisions and consists of the following two components:

   1) Initial Investment Analysis – Initial Investment Analysis evaluates alternative solutions to mission needs and provides realistic options to the Investment Decision Authority (IDA) to support the Initial Investment Decision (IID).

   2) Final Investment Analysis - Final Investment Analysis develops detailed plans and final requirements for the IDA-selected investment opportunity in support of the Final Investment Decision (FID).

   4) Solution Implementation (SI) - SI begins at the FID when the IDA gives approval to the service organization to proceed with implementation of the selected investment opportunity. The overarching goal of SI is to satisfy program requirements and achieve the benefit targets in the Business Case Analysis (see Section 5 for a description of the Business Case Analysis).

   5) In-Service Management (ISM) - ISM begins at the In-Service Decision (ISD) when a new system or service is commissioned for operational use. The primary goal of ISM is to ensure that FAA systems, services, and facilities are operated, maintained, secured, and sustained in real-time to provide the level of service required by users and customers. In addition, ISM provides periodic monitoring, evaluation, and improvements for fielded systems, services, and facilities.

Figure 3-1 illustrates the typical T&E approach leading to the In-Service Decision. The diagram depicts all major AMS lifecycle phases starting with Research for Service Analysis through

Service Analysis & Strategic Planning and CRD, IA, SI, and ending with ISM. The diagram also indicates the key decisions, milestones, major test efforts, technical reviews, and most importantly, the major T&E work products and when they would be initiated relative to the AMS lifecycle phase. This figure depicts the typical FAA program lifecycle, and the implementation of specific activities (i.e., test efforts or T&E work products) or events (i.e., key decisions, milestones, or technical reviews).

Note: Each program is unique and may deviate from the typical lifecycle approach.

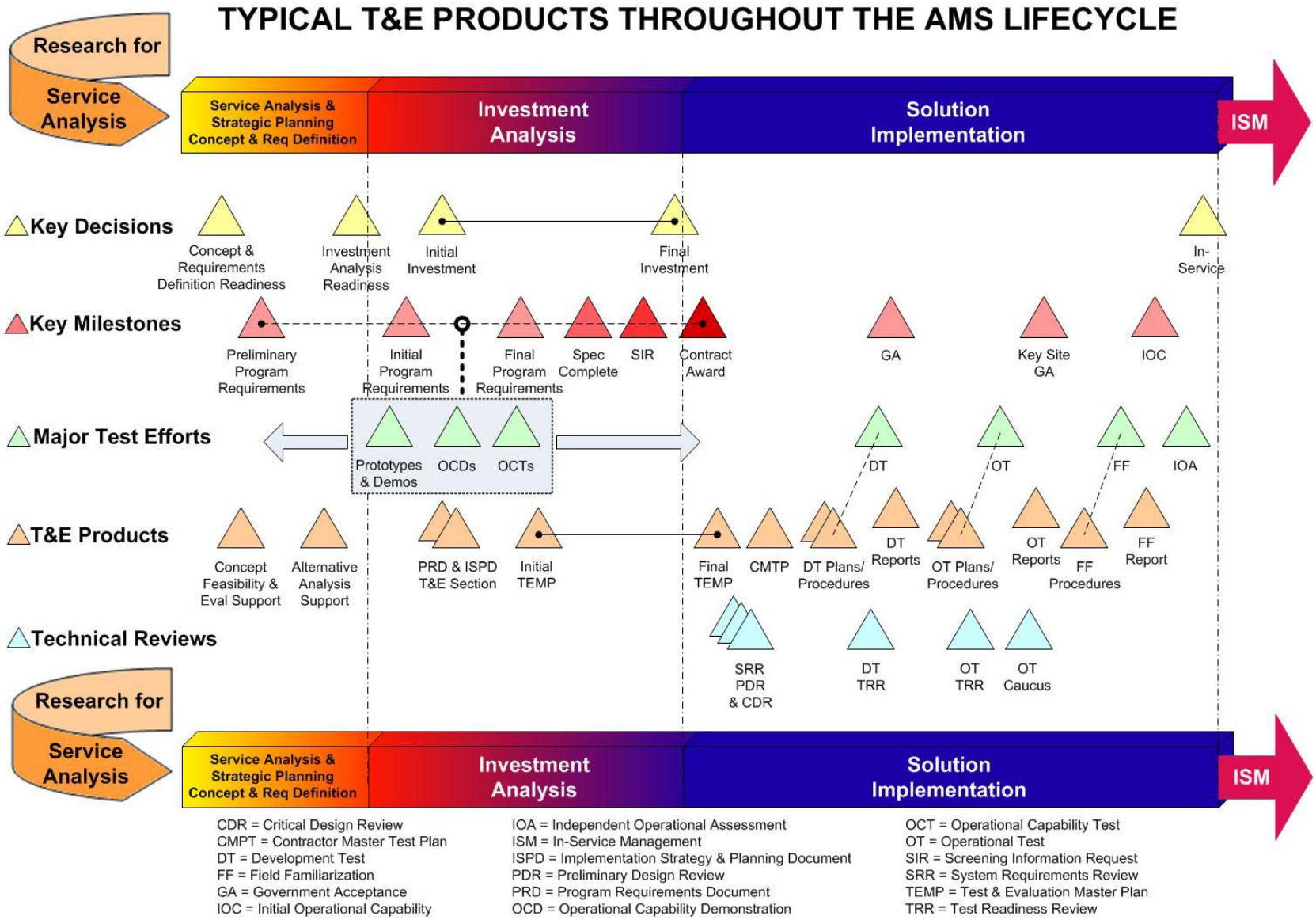

FIGURE 3-1. TYPICAL T&E APPROACH THROUGHOUT THE AMS LIFECYCLE

Sections 4 through 8 of this handbook identify and define the specific T&E support required for each of the AMS program lifecycle phases.

4 T&E SUPPORT TO SERVICE ANALYSIS & STRATEGIC PLANNING AND CONCEPT & REQUIREMENTS DEFINITION

T&E support to Service Analysis & Strategic Planning and CRD generally consists of early evaluations performed in support of concept feasibility determinations and analysis of alternative solutions. Early evaluations may be used throughout the program planning process (i.e., during both Service Analysis & Strategic Planning and CRD and IA) to minimize program risks. Early evaluations include:

a) Prototype tests

b) User demonstrations

c) Studies

d) Modeling

e) Simulations

f) Operational Capability Demonstrations (OCDs)

g) Operational Capability Tests (OCTs)

Prototype tests, user demonstrations, studies, modeling, and simulations are used to support system engineering processes in developing requirements, evaluating concepts (including human factors), and selecting technologies. OCDs and OCTs are used to provide a means of selecting from among candidate solutions.

These evaluations may be conducted on functionally equivalent prototypes or on early development systems, and may be used to provide field personnel with early exposure to new systems under development. The focus is to identify product flaws or possible enhancements prior to generating production systems (i.e., when it is least costly to implement corrective measures or improvements). Information from early evaluations is used to develop work products for:

a) Evaluating operational concepts

b) Supporting alternative analysis decisions

c) Developing requirements for the preliminary Program Requirements Document (pPRD)

In keeping with best practices, early evaluations should adhere to the same fundamental T&E practices as employed in SI: early user involvement, proper planning, sound engineering, and comprehensive testing and analysis. Early evaluations may result in changes to product specifications, Commercial Off-the-Shelf (COTS) hardware or software, operational requirements, or vendor selections. These evaluations can also provide information for the focus of future test activities. The test processes from the DT and OT sections of this handbook (Sections 6 and 7) should be used during these evaluations to ensure a systematic approach and properly documented results.

5 T&E SUPPORT TO INVESTMENT ANALYSIS

T&E support to IA consists of the initial development of T&E program planning as documented in the Program Requirements Document, Implementation Strategy and Planning Document, and the Test and Evaluation Master Plan. Additionally, T&E support during this phase may include the continuation (or the initiation) of early evaluations begun during Service Analysis & Strategic Planning and CRD (see Section 4).

The set of acquisition planning and control documents generated during IA are as follows:

a) Program Requirements Document (PRD) – defines the operational framework and performance baseline for an acquisition program. It is the basis for evaluating the readiness of products and services of an acquisition program to become operational

b) Implementation Strategy and Planning Document (ISPD) - provides a summary of the plans for solution implementation and in-service management of the proposed acquisition to the investment decision authority

c) Acquisition Program Baseline (APB) - defines the cost, schedule, and performance baselines for the system or service acquisition. It is the mutual agreement between the investment decision authority, the providing service organization, and the operating service organization concerning the performance and capability that the system or service will provide and the authorized cost and schedule

d) Business Case Analysis - provides summary cost, schedule, and benefit information for each alternative solution to the mission need for use by the investment decision authority when making initial and final investment decisions. (Note: The Business Case Analysis is not directly used for T&E program planning, but may provide useful background information for T&E strategy development)

The planning and support described in this section details the T&E program planning based on the framework established in the program acquisition planning and control documents. Specifically, the T&E support to the development of the PRD and ISPD, along with the development of the Test and Evaluation Master Plan (TEMP), is described in Sections 5.1 to 5.6. Additionally, Appendix D identifies the major test planning work products along with their associated review and approval cycles.

5.1 PROGRAM REQUIREMENTS DOCUMENT SUPPORT

The PRD is developed by the Program Office and approved by the Vice President of the organization executing the acquisition during Solution Implementation and the Vice President of the operating organization. In accordance with the FAA Acquisition Management System (AMS), the preliminary PRD is developed during the CRD phase in preparation for the Investment Analysis Readiness Decision. Program requirements are refined in the initial PRD prior to the Initial Investment Decision and are further refined in the final PRD prior to the Final Investment Decision. The T&E section of the PRD is developed during the initial PRD (iPRD) in support of the Initial Investment Decision (IID). T&E support for the development of program requirements during PRD development includes:

a) Participating in product engineering and implementation reviews

b) Ensuring that all new or modified requirements for functions or services are defined and address the operational mission

c) Ensuring that all interfaces required for the National Airspace System (NAS) operational mission are defined

d) Reviewing and commenting on requirements for testability. (Requirements must be precisely defined and leave no room for subjective interpretation. Parameters and thresholds must be measurable. Functional performance requirements must be verifiable and expressed in unambiguous terms)

e) Verifying that Critical Operational Issues (COIs) are completely described, are operational in nature, represent observable events, and are testable

f) Verifying that program requirements essential to meeting the mission are identified as Critical Performance Requirements (CPRs)

g) Structuring the test program to address all target system or subsystem components and interfaces by:

   1) Defining potential test strategies and seeking feedback from engineering and implementation teams

   2) Providing test strategy briefings to the Program Office as required

   3) Writing the T&E section of the PRD to include essential FAA and contractor tests

Refer to Appendix D, Figure D-1, for the complete T&E section of the PRD review and approval cycle.

Note: Refer to the V&V Repository for a sample of the T&E section of the PRD.

5.2 IMPLEMENTATION STRATEGY AND PLANNING DOCUMENT SUPPORT

The ISPD defines the overall strategy for an FAA program. The T&E section of the ISPD defines the program's T&E strategy. The ISPD T&E strategy identifies high-level aspects of testing, including resources, roles and responsibilities, site selection, scheduling, training, planning, and reporting. It addresses any planned product upgrades, and contractor and Government roles and responsibilities.

T&E support for the ISPD includes supporting the development of the T&E section. System complexity, contracting approach, project schedule, and impact on the NAS are considered when developing the test program strategies. Both contractor and FAA test activities are addressed with an overall structure and outline of planned testing. Any approach to streamlining testing is identified with an explanation of how the test strategy will mitigate program and operational risks.

The T&E section of the ISPD is developed by the DT and OT Test Directors in conjunction with the initial TEMP. The T&E section of the ISPD should be consistent with the strategies detailed in the TEMP. The development of the T&E section of the ISPD is supported by the Integrated Test Team (ITT). The ITT is comprised of Program Office representatives, stakeholders, DT and OT test personnel, ISM test personnel, system engineers, Subject Matter Experts (SMEs),

and is jointly chaired by the DT and OT Test Directors. (For additional information on the ITT, refer to the TRRG.)

The T&E section of the ISPD requires endorsements from the TSB, Technical Strategies and Integration (TSI) Senior Manager and the responsible T&E Senior Manager. After these endorsements, final approvals from the Technical Center Director and the Program Manager are required. On programs designated for Independent Operational Assessment (IOA), the Independent Safety Assessment Team also approves the ISPD T&E section.

Refer to Appendix D, Figure D-2, for the complete T&E section of the ISPD review and approval cycle.

Note: Refer to the V&V Repository for a sample of the T&E section of the ISPD.

5.3 TEST AND EVALUATION MASTER PLAN DEVELOPMENT

The TEMP is the primary test management document for the acquisition program throughout its lifecycle from Investment Analysis through In-Service Management. It describes the baseline test strategy and the scope of a test program. The TEMP delineates all activities that must be performed to achieve the goals of V&V. It also documents the T&E methodologies that will be used to assess safety hazard controls and security risks. All programs will be required to submit a TEMP, unless a waiver is approved by the Technical Center Director.

The TEMP is developed and managed through a collaborative effort of the ITT. The initial TEMP for each ANG T&E program must be submitted by the DT and OT Test Directors for approval by the Program Manager and the Technical Center Director prior to the Final Investment Decision. The TEMP is a "living document" that is subject to change in both level of detail and content as the program progresses. The initial TEMP is not expected to contain the complete level of detail required to fully implement the T&E program. However, the initial TEMP must contain estimates of the testing scope that are sufficient to address ISPD requirements and development of T&E requirements for the Screening Information Request (SIR).

The TEMP is updated as the program changes and more detailed supporting information becomes available. Unaddressed or incomplete areas within early TEMP versions which require refinement must be identified as "To Be Determined" and must be included in the final or revised final versions as additional information becomes available. The final TEMP should be completed within 60 days after Contract Award, and is generally revised at major program milestones (see Section 5.3.2). The initial TEMP, final TEMP, and all revisions to the final TEMP impacting test strategy or scope require Test Standards Board (TSB) endorsement and the approval signatures of the Program Manager and the Technical Center Director. Minor changes to the TEMP that do not impact test strategy or scope (e.g., minor schedule changes, editorial corrections, etc.) will be considered working drafts only and do not require these approval signatures but are still subject to Document Management and Control. The T&E strategies and methods described in the TEMP should be briefed to the Program Manager to obtain input and concurrence with the general T&E approach. The briefing should occur prior to submitting the initial and final TEMP for the Program Manager's review and approval.

Refer to Appendix D, Figure D-3, for the complete TEMP review and approval cycle.

Note: Refer to the V&V Repository for the TEMP templates and TEMP samples.

5.3.1 TEMP OBJECTIVES

The TEMP must accomplish the following objectives to ensure a comprehensive test program:

a) Provide structure for managing the T&E effort

b) Define a test plan baseline that addresses all required test activities

c) Document the ITT's consensus on the scope of testing that is required to evaluate the system or service in a thorough and efficient manner

d) Define test strategies and evaluation methods for the system(s) or service(s) under test

e) Identify operational requirements to be verified and validated

f) Establish requirements traceability to the Critical Operational Issues (COIs), Measures of Effectiveness (MOEs), Measures of Suitability (MOSs), and Measures of Performance (MOPs)

g) Define a logical schedule of T&E activities

h) Specify equipment and resource requirements to support testing

i) Specify T&E roles and responsibilities

j) Define an approach for specialized evaluation areas (e.g., human factors, security, and safety)

k) Identify test tools and capabilities that require development and accreditation

l) Fully define test limitations and their respective impacts on evaluation elements

m) Define training requirements and plans

n) Define the T&E plan for support of major program decisions

o) Document test program risks

p) Define how the results of testing will be reported (e.g., Interim Assessment Reports, Development Test Reports, and Operational Test Reports)

5.3.2 TEST MANAGEMENT USING THE TEMP

The generic data flow of the information necessary to develop and maintain a TEMP and the process areas that are managed through the use of a TEMP are depicted in Figure 5-1. TEMP Relational Flow Diagram. The following sections expand upon the relationships depicted in this figure.

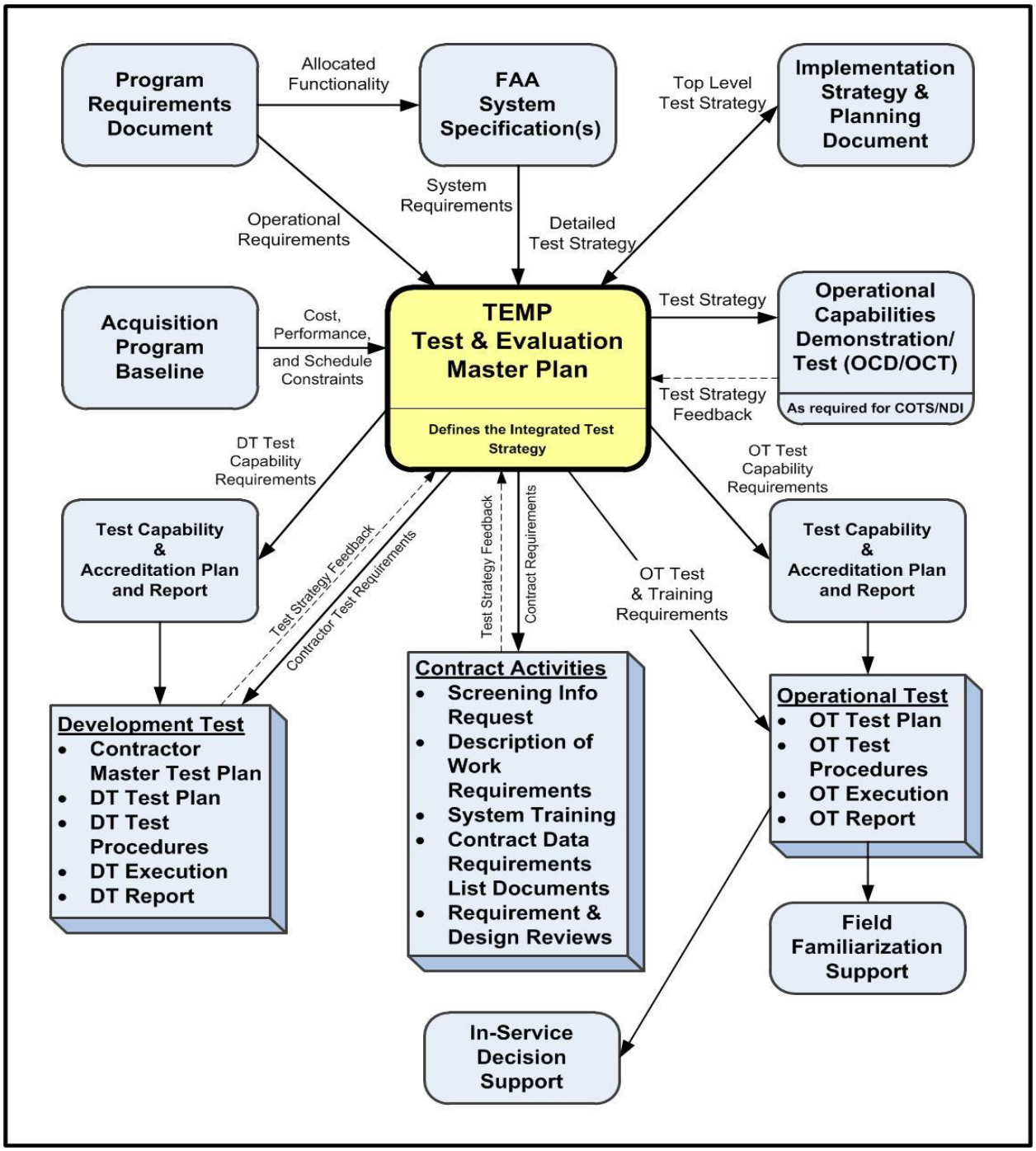

FIGURE 5-1. TEMP RELATIONAL FLOW DIAGRAM

The acquisition planning and control documents (see Section 5) and the FAA procurement specification are the basis of the programmatic test objectives and constraints upon which the TEMP must be developed. The test strategies defined in the TEMP must support those contained in the ISPD. Development of the TEMP may start prior to completing the test section of the

ISPD. The TEMP must contain more refined details which support the higher level descriptions contained in the ISPD.

The TEMP contains strategies to be used to plan the conduct of the Operational Capability Demonstrations (OCDs) and Operational Capability Tests (OCTs). The DT section of the TEMP defines the test strategies and scope to be allocated to a contractor-conducted DT. Since the TEMP contains the integrated test approach for evaluating the system or service, it must define the details of test and support requirements to be obtained from the procurement contractor in support of both DT and OT. These requirements are to be included in the SIR. The TEMP will be updated, as required, based on the results and findings of the OCDs, OCTs, and DT.

The TEMP must define the scope of the OT effort. Subsequent OT plans must reflect the test strategies and scope defined in the TEMP. The basis of the strategies will be defined in the TEMP, including which DT tests will be relied upon to support OT validation of requirements. The simulation, modeling, and/or test tools required to execute the OT strategy must be defined so that their acquisition and accreditation can be effectively managed.

As the system acquisition progresses, the strategies defined in the TEMP must be reassessed. Changes to the TEMP are required when previously developed test strategies are no longer valid, or if new system performance risks are identified. The TEMP must be updated:

a) At major milestones (e.g., Contract Award, Critical Design Reviews (CDRs), Contractor Master Test Plan (CMTP) issue/updates, and OT Test Plan issue/updates)

b) When the program baseline has been impacted

c) When the ISPD has been significantly modified

d) When the program is significantly changed or restructured

5.3.3 TEMP DEVELOPMENT

The TEMP defines the required T&E activities and resources to accomplish program goals. The DT and OT Test Directors are responsible for producing the TEMP through the ITT. The program follows the approved TEMP to budget for T&E resources and scheduled activities. It is imperative that all T&E stakeholders participate early in the program and throughout the program lifecycle to ensure that a comprehensive and effective test program is developed and implemented.

The ITT develops the test design that is documented in the TEMP by researching information from various sources including program requirement documents, associated architectures, Concept of Operations (CONOPs) documents, Commercial Off-the-Shelf (COTS) and/or Non-Development Item (NDI) design documentation, and the performance and capability requirements.

The following sections describe the test design process as depicted in Figure 5-2, Generic TEMP Test Design Process.

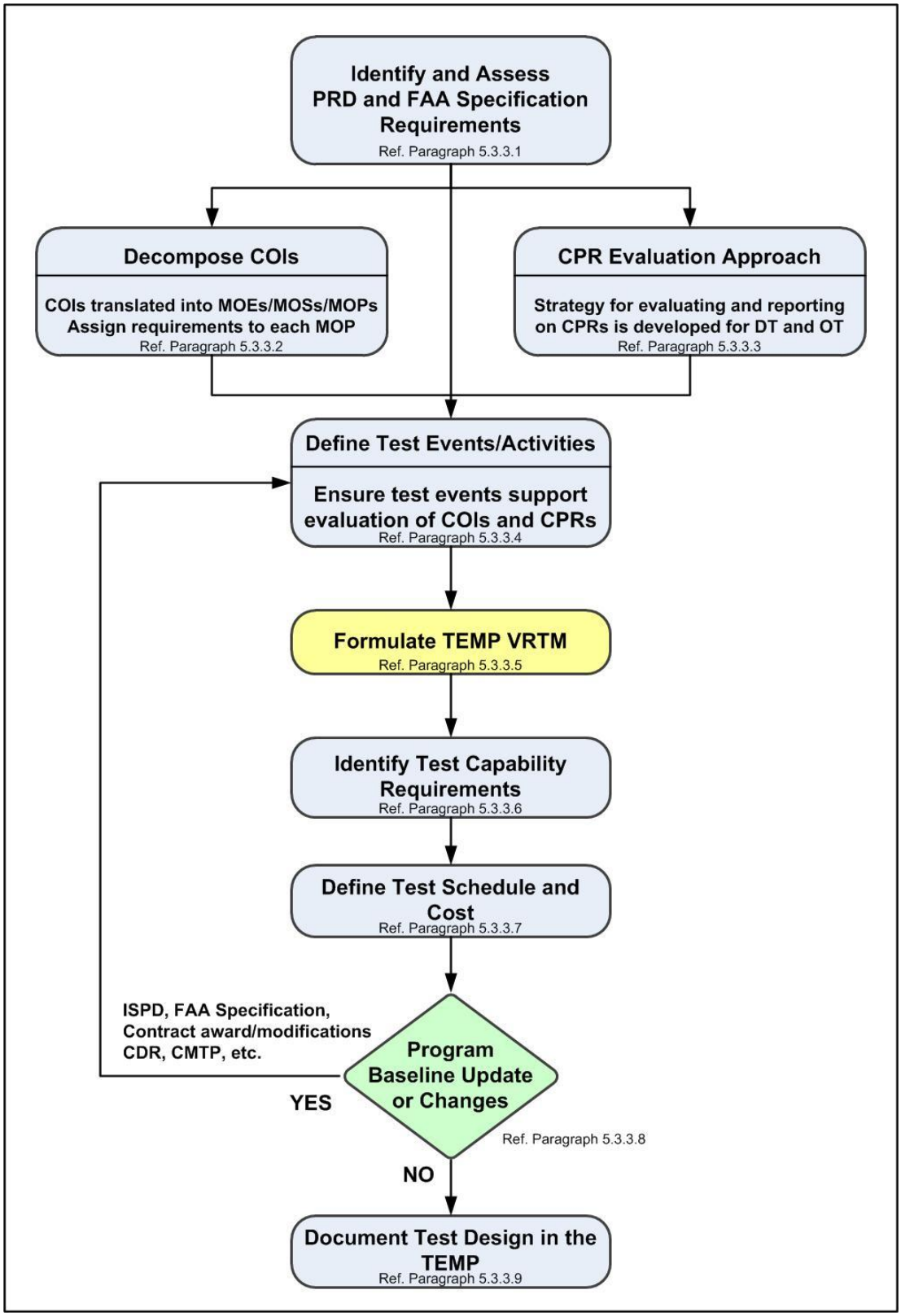

FIGURE 5-2. GENERIC TEMP TEST DESIGN PROCESS

5.3.3.1 IDENTIFICATION AND ASSESSMENT OF REQUIREMENTS

The initial step in developing a test design is to identify a complete set of requirements within the scope of the test effort. System requirements are defined in the program's PRD and FAA system specification(s). Each requirement must be thoroughly analyzed to gain a comprehensive understanding of the system or service being acquired.

To perform the system requirements assessment, the ITT considers the following aspects of the system or service to be acquired:

a) Mission

b) System or service requirements

c) Available test capabilities and their limitations

d) Application and operational concepts

e) Major operational changes or impacts on the NAS that may be introduced by the new program or service

f) Acquisition strategies and issues that may impact the T&E process

g) Expected scope and size of software and hardware development efforts

h) Safety and security risks

i) Operational environments, configurations, and conditions in which the system is intended to be placed.

5.3.3.2 DECOMPOSITION OF CRITICAL OPERATIONAL ISSUES

Critical Operational Issues (COIs) are defined in an FAA procurement program's PRD. A COI is a critical element or operational objective that must be examined during testing to determine the system's overall capability to support mission accomplishment. COIs are stated in the form of a question at a high level and usually cannot be answered directly from a single test or measurement. Therefore, each COI must be broken down into quantifiable measures that, when combined, fully support resolution of the critical issue.

A COI is decomposed into Measures of Effectiveness (MOEs) and Measures of Suitability (MOSs), both of which are further decomposed into Measures of Performance (MOPs). MOEs and MOSs are sub-questions of the COI which refine details that must be answered to fully determine whether a COI has been satisfied. MOPs are quantitative/qualitative values that characterize and support the evaluation of the COIs, MOEs and MOSs, and are measurable by a test process.

An MOE evaluates the degree to which a system accomplishes its mission when used by representative personnel in the expected operational environment. Examples of MOEs are accuracy, coverage, probability of detection, tracker performance, system capacity, and data timeliness.

An MOS addresses system characteristics that determine whether it is suitable for use in the NAS. Suitability measures include:

a) Reliability

b) Maintainability

c) Availability
d) Compatibility
e) Transportability
f) Interoperability
g) Safety
h) Human factors
i) Logistics
j) Supportability
k) Documentation
l) Personnel
m) Training requirements
n) Site adaptability
o) Fault tolerance
p) Security

An MOP is derived from one or more MOEs or MOSs and directly translates into a test requirement. Once COIs have been fully decomposed into MOPs, program requirements are associated to one or more MOPs.

Note: Refer to the V&V Repository for the COI Decomposition Guide and a COI Decomposition sample.

5.3.3.3 CRITICAL PERFORMANCE REQUIREMENTS EVALUATION APPROACH

CPRs are program requirements deemed essential to the successful performance of the system or service in meeting the acquisition program's mission needs. Special emphasis is placed upon the evaluation of CPRs to ensure the timely assessment of system or service capabilities and to promote program success.

Therefore, CPRs are tracked and their status is reported throughout the test program to provide visibility to management in support of making prudent decisions. The evaluation approach should determine the strategy for testing the CPR and the required milestones for assessing CPR performance. Expected performance under specific conditions, environments, and configurations is determined for each CPR.

Core CPRs should be established in the program's PRD. If they have not been delineated in the PRD or the APB, then it is recommended that they be identified by the ITT. Additional CPRs may also be identified from other program work products. The full set of CPRs will be documented in the TEMP.

5.3.3.4 DEFINING TEST ACTIVITIES

Requirements are allocated to a set of DT and OT test activities to support a structured evaluation of the system. Development of test activities should consider the following aspects of test:

a) CPRs
b) NAS integration requirements
c) System interface requirements testing
d) Degraded mode operations
e) Stress and NAS loading
f) Failure recovery
g) Air Traffic (AT) and Technical Operations evaluations
h) System or service certification requirements
i) Transition and switchover/fallback
j) Site adaptation
k) Human Factors (HF) evaluations
l) Security evaluations
m) Supportability evaluations
n) Safety requirements and potential new safety hazards
o) Monitoring and control
p) Integrated operations
q) Stability
r) Hardware requirements
s) Software requirements
t) Functional performance
u) Reliability, Maintainability, and Availability (RMA)
v) Test NAS Change Proposals (NCPs) (see Section 9.3)

For DT, standard test activities (as defined in Section 6.1.1) are identified as DT Software Testing, DT Hardware Testing, Factory Acceptance Testing (FAT), Functional Qualification Testing (FQT), DT Integration Testing, DT System Testing, Production Acceptance Testing (PAT), Site Acceptance Testing (SAT) and DT Regression Testing.

For OT, standard test activities (as defined in Section 7.1) are identified as NAS Integration Testing, and Operational Effectiveness and Suitability Testing. For the latter, this test activity may be further subdivided into the specific test activities of Reliability, Maintainability, Availability, Supportability, Degraded Operations, Stress and NAS Loading, Human Factors, Safety, Security, Site Adaptation, Transition, Certification, Training and OT Regression Testing.

As part of CMTP, DT Test Plan, and OT Test Plan development, test activities are broken down into individually executable test cases in which functionally related requirements are tested. For larger or more complex test programs, individual test cases within a test activity may be organized into test case groups for execution and/or reporting purposes. Ultimately, conditions for each test case should define the required loads, configurations, adaptations, and environments. Allocation of test activities and their individual test cases should support the test strategies defined in the T&E section of the ISPD.

5.3.3.5 FORMULATING THE TEMP VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

The TEMP Verification Requirements Traceability Matrix (VRTM) provides a structured approach that ensures planned testing is comprehensive and complete. It maps all COIs/MOEs/MOSs/MOPs as well as the program requirements into T&E phases (DT or OT) and associated test activities (see Sections 6.1.1 and 7.1 for descriptions of the DT and OT test activities). Additionally, each MOP and program requirement contained in the TEMP VRTM is assigned one or more of the following test verification method(s):

a) Demonstration (D): Verification that is accomplished by operation, adjustment, or reconfiguration of items performing their designed functions under specific scenarios. The items may be instrumented and quantitative limits of performance monitored, but only observational data rather than actual performance data is required to be recorded for verification. Demonstration is often used to verify compliance with requirements in servicing, reliability, maintainability, transportability, and human factors engineering.

   Note: Demonstration does not require any actions beyond those identified in the Test Steps section of the associated test procedures.

b) Test (T): Verification that is accomplished, with or without instrumentation, through systematic exercising of the application item under appropriate conditions with the collection, analysis, and evaluation of quantitative data.

   Note: Acceptability of the item is determined by comparison of the data with pre-established quantitative criteria, requirements, and occurrences.

c) Analysis (A): Verification that is accomplished through use of one or more of the following analysis techniques to prove that an item meets specified requirements:

   1) Mathematical representation such as math models, algorithms, and equations
   2) Charts
   3) Graphs
   4) Circuit diagrams
   5) Data reduction/recording
   6) Representative data (may include data collected from previous or other equipment and system verifications)

d) Inspection (I): Verification that is accomplished by a visual examination of the item, reviewing descriptive documentation, and comparing the appropriate characteristics with predetermined standards to determine conformance to requirements without the

use of laboratory equipment or procedures. Examples of verification by inspection are:

1) Visual analysis of the item under test, such as displays, cables, and processors.
2) Reviewing descriptive documentation such as Contract Data Requirements List (CDRL) items, vendor data, and engineering drawings.
3) Comparing the appropriate characteristics with a predetermined or reference standard such as FAA and industry standards.

Development of the VRTM is an iterative process. During early TEMP development, the TEMP VRTM is generated with a mapping of COIs/MOEs/MOSs/MOPs and program requirements down to the test phase level for DT and down to the test activity level for OT. As the program progresses, additional information such as that included in the ISPD, the CMTP, and the FAA specification will provide further details that must be incorporated into the VRTM.

For DT, the developing contractor will use the FAA System Specification to develop their contractor specification(s) defining the DT requirements. The CMTP will then be developed, containing a DT VRTM which maps the DT requirements to the DT test activities. Subsequently, the developing contractor will refine the DT VRTM with test case information during DT Test Plan development (see Sections 6.2.2, 6.2.3, and 6.2.5). The TEMP VRTM should be updated with the DT test activity and test case information from the DT VRTM.

For OT, the TEMP VRTM will provide the basis for developing the OT VRTM. During OT Test Plan development, the VRTM will be further refined to include COI/MOE/MOS/MOP and program requirement mapping to the individual OT test cases (see Sections 7.4.1 and 7.4.2).

Note: Refer to the V&V Repository for the VRTM template.

5.3.3.6 IDENTIFYING TEST CAPABILITY REQUIREMENTS

Test methodologies and scenarios are reviewed to identify the test tools and environment. Test tools and environment requirements should be identified in a consolidated list for traceability, including associated "need by" dates. Particular focus is placed on items with long lead times or high costs. Typical examples include the preparation, procurement, or development of: NAS interfaces that require significant coordination; telecommunications services; test tools; models and simulations; and laboratories and testbeds.

The set of all test methodologies, scenarios, and conditions are primary drivers for assessing required test tools and environments. When assessing the need for test tools and environments, the following factors should be considered:

a) Measures of Performance: Reviewing MOPs provides insight into the resources that may be required to collect and analyze data. Instrumentation, databases, data extraction tools, questionnaires, and analysis tools are examples of resources that may be required.

b) Test conditions: Reviewing the required test conditions (e.g., loads, configurations, adaptations, and environments) provides insight into the required resources.

c) Test methodology: How a set of test activities is executed also contributes to the rationale or basis for resource requirements. Reviewing the test methodologies

provides insight into what might be needed to execute the test activities (e.g., field testing may add costs, modeling and simulation may incur both increased costs and potentially long lead times for development, etc.).

d) Test scenarios: Test scenarios are developed to exercise combinations of operational factors which influence system performance. Reviewing all factors that have been identified may provide insight into additional assets that may be required to approximate operationally realistic Air Traffic Control (ATC) situations and capture "end-to-end" situational flow.

5.3.3.7 DEFINING TEST SCHEDULE AND COSTS

Test program schedule and costs are derived from and based on the test design and associated program constraints. Test program schedule and costs can be impacted by program constraints which should be identified using the Risk Management process defined in the NAS System Engineering Manual (SEM). The test team can draw on historical data from test programs of equivalent complexity and risk to develop the test design for a program. This data may be accessed from T&E work product archival data from other test programs. Historical data may also be used to assess T&E tasks to establish durations and resource estimates. The initial test schedule milestones and completion dates are developed by linking them to key program milestones and acquisition decision points. The test schedule is further refined by defining T&E tasks for each test milestone and completion date. Finally, the test schedule dependencies are established by linking all associated T&E tasks, as well as other program milestones and completion dates that relate to the T&E tasks. This final schedule becomes the test program baseline.

The test team establishes a test program cost baseline by correlating required resource elements such as personnel, test tools, and test environments to tasks on the test program baseline schedule. The test team must assign cost estimates to each resource element and maintain an itemized spreadsheet to account for and justify the total cost estimate for the test program. Every resource element must link to a T&E task on the test program baseline schedule. All planning and management of T&E program costs and schedules should be done in accordance with the T&E Project Management Process Description Document (PDD).

Note: Refer to the V&V Repository for the Project Management PDD standard.

5.3.3.8 ASSESSING UPDATES AND ACQUISITION PROGRAM BASELINE CHANGES

As additional information becomes available or changes to the APB are made, the test design must be reassessed to ensure that the assumptions made in the test design are still valid. If changes in assumptions impact the ability of the test design to verify and validate the system under test, changes must be made to the test design.

5.3.3.9 DOCUMENTING THE TEST DESIGN IN THE TEMP

The TEMP documents the test design from a set of defined process steps as depicted in Figure 5-2. As described in the previous sections, the test design is based on the following factors: the complete set of system requirements; the decomposition of COIs that must be examined during testing; the set of CPRs that must be evaluated, tracked and statused; a set of DT and OT activities that support a structured evaluation of the system; a structured VRTM to ensure that

testing is comprehensive and complete; a set of necessary test capability requirements; the test schedule, cost and resources; and an assessment of updates and APB changes.

When an acquisition program's test design is completed and documented, its supporting factors form the basis for the TEMP and any updates.

5.3.3.10 INTERIM ASSESSMENT REPORT PLANNING

The Interim Assessment Report (IAR) can play an important role in the early identification of program issues, risks and change opportunities. It is a recommended method to provide management with the status of critical requirements and operational issues during a program's design, development, and test phases. This assessment can support programmatic decisions to help ensure that the program meets its cost, schedule or performance objectives prior to going into operations. Test program IAR planning activities include describing how and when IAR's will be provided, and to whom the IAR's will be delivered. Reporting milestones and methods for IAR's are typically based on cost, schedule and complexity of the program. The selection of milestones for when IAR's are planned to be delivered should consider when critical decisions points in the program can be best supported by the report and the availability of meaningful data. Recommended reporting milestones include major reviews (e.g., preliminary, critical, software, system and program design reviews), software development, start of formal DT, completion of DT, and start of OT. The OT Test Director documents strategic plans for IAR's in the TEMP and is the responsible individual for the deliverable. For more on the IAR content, see Section 7.7.1, OT Interim Assessment Report.

5.4 FAA SYSTEM SPECIFICATION SUPPORT

The DT and OT Test Directors and designated test team members participate in developing the FAA System Specification. The specification describes the physical, functional, or performance requirements of a system or service to be obtained from a contractor and contains criteria for determining whether or not the requirements are met. The test teams evaluate the testability of each specified requirement and assess the method of how each requirement should be verified. The Test Directors and test teams also develop the verification section of the specification. The following activities are performed in reviewing and developing requirements in the FAA System Specification:

e) Review proposed software, hardware, and system designs as defined by system engineering teams.

f) Conduct prototype evaluations (as required) to support requirements definition.

g) Attend product engineering and implementation reviews.

h) Ensure that requirements for all new and affected system components or subsystems are defined and that they address operational requirements.

i) Ensure consistency with operational requirements in the PRD.

j) Evaluate the validity of the requirements from an operational perspective.

k) Ensure that all critical interfaces are defined.

l) Review and comment on requirements for testability:

1) Requirements related to COTS/NDI products should only describe functional system level requirements, since subsystem level parameters are already documented in the vendor COTS/NDI specifications.

2) Requirements must be clearly defined and leave no room for subjective interpretation. Parameters and thresholds must be measurable. Functional performance requirements must be written in unambiguous terms.

Note: Refer to the V&V Repository for the Requirements Review guidance.

a) Assess the product components, system design, and system implementation approach for developing potential test strategies.

b) Define potential test strategies and seek feedback from implementation and engineering teams. Provide test specification briefings to the Program Office, as required, to attain buy-in.

c) Develop test program structure to address target system components, subsystems, and critical interfaces.

d) Write the verification section of the FAA System Specification to define essential verification areas and methods and strategies that are required to verify the documented requirements.

e) Ensure that operational considerations have been incorporated in the selection of verification methods (inspection, analysis, demonstration, and test).

Note: Refer to the V&V Repository for an FAA System Specification sample.

The DT Test Director must ensure that all T&E-related input to the FAA System Specification has been peer-reviewed prior to submission (see Section 1.9).

5.5 SCREENING INFORMATION REQUEST (SIR) SUPPORT

The FAA procures systems or services from contractors using agreements defined in contracts. Before it can select a contractor to provide the system or service, the FAA issues a SIR to define the specific efforts to be provided by the contractor. The test strategy from the TEMP is the basis for determining what test and evaluation items belong in the SIR. The DT and OT Test Directors must ensure that this test strategy is properly reflected in the SIR as described in the following sections. Additionally, the DT and OT Test Directors must ensure that all T&E-related input to the SIR has been peer-reviewed prior to submission (see Section 1.9).

5.5.1 SECTION L OF THE SIR: INSTRUCTIONS, CONDITIONS, AND NOTICES TO OFFERORS

Section L of the SIR contains a description of the technical requirements that the contractor must address within the proposal that they submit in response to the SIR. Contractor proposal requirements that may be addressed in Section L of the SIR with respect to testing include:

a) Relevant experience of the contractor in testing similar systems

b) DT cost and schedule information

c) Test tools to be used

d) Test environment(s) proposed for formal tests

e) Integration and test management approach

f) Proposed test approaches and strategy to include expected conditions for CPR evaluation

g) Specific operational conditions and loading that supports early evaluation of operational capabilities during DT

h) Cost information for OT support

i) Test Configuration Management (CM) methods and practices to be used

j) OCD/OCT evaluation criteria (if required)

k) Risk management approach

5.5.2 SECTION C OF THE SIR: DESCRIPTION OF WORK REQUIREMENTS

Section C of the SIR contains the description of the work to be performed under the contract. This section typically includes one of the following Government developed documents: Statement of Work (SOW), Performance Work Statement (PWS) or Statement of Objectives (SOO). The subsequent sections define each document purpose followed by a list of T&E areas that should be considered when drafting the description of work requirements.

5.5.2.1 STATEMENT OF WORK (SOW)/PERFORMANCE WORK STATEMENT (PWS)

The SOW defines the specific tasks that the contractor must perform. The SOW should specify in clear, understandable terms the work to be done in developing or producing the goods to be delivered or services to be performed by the contractor. The SOW forms the basis for successful performance by the contractor and effective administration of the contract by the government. A well-written SOW serves as the standard for determining if the contractor meets the stated requirements.

A PWS is a statement of work for performance-based service acquisitions (PBSAs) that describe the required results in clear, specific and objective terms with measureable outcomes. The key to a PBSA is that all aspects of the acquisition are structured around the expected outcome. This shifts the performance risk away from the government and often results in savings by allowing the contractor to provide innovative solutions for the stated need. A PWS is typical of a contract that engages the time and effort of a contractor whose primary purpose is to perform an identifiable task rather than to furnish an end item.

The SOW/PWS should accomplish the following T&E goals that are common across most FAA acquisitions:

a) Describe the T&E events and activities to be accomplished by the contractor that reflect the program T&E strategy described in the TEMP, ISPD and Integrated Master Schedule (IMS)

b) Indicate the use of T&E processes that are critical for program success (e.g., test program management, integrated testing, test capability accreditation, discrepancy reporting etc.)

c) Ensure that the government has access to contractor data, test activities, and results

d) Government review and approval of contractor deliverables such as test plans, procedures and reports

e) Contractor T&E support for government run testing (e.g., contractor personnel, government training, meetings, DR/PTR review boards, test readiness reviews, etc.)

Note: Refer to the V&V Repository for the FAA Statement of Work (SOW) Preparation Guide and SOW sample.

5.5.2.2 STATEMENT OF OBJECTIVES (SOO)

A SOO is used when the government intends to provide the maximum flexibility to each offeror to propose innovative approaches to meet the government's needs. The SOO is prepared by the government in lieu of a SOW or PWS and provides the purpose, scope and top level objectives of the acquisition. The SOO is used by the offeror to develop a SOW or PWS as part of their proposal. The SOO does not become part of the contract. The offeror's SOW or PWS should be structured for the proposed system solution and not restricted by the structure of the government's SOO. The government should develop a cross-reference matrix tracking the government SOO requirements to the offeror's proposed SOW or PWS.

Consider the following when developing the T&E content for the SOO:

a) The T&E approach documented in the government TEMP that covers the program acquisition phase

b) Integration of key T&E processes with program management and engineering processes (e.g., risk management, requirements management, configuration management, IMS development, status/problem reporting, etc.)

c) Cost or schedule savings associated with use of contractor T&E best practices and processes that supports program execution

d) Use of event-driven program milestones, T&E reviews and activities (e.g., CDRs, Test Readiness Reviews (TRRs), and entrance/exit criteria)

e) Use of commercial products/processes/standards to reduce cost or schedule

f) Government participation on contractor teams to assess program progress

g) Contractor participation in government T&E reviews and activities (e.g., test readiness, technical reviews, data reviews, OT, etc.).

5.6 PROPOSAL EVALUATION SUPPORT

The DT and OT Test Directors and designated test team members review the contractor proposals. The Test Directors are the SMEs for reviewing the test portion of the proposals. However, the Test Directors also review other portions of the proposals to assess potential impacts to the test program.

For competitive solicitations, the DT and OT Test Directors evaluate the proposals for technical content against technical evaluation criteria specified in the proposal evaluation plan. For noncompetitive proposals (sole source procurements and Engineering Change Proposals

(ECPs)), the Test Directors assist in the evaluation of the proposed costs as well as the technical content of the proposal.

Note: Refer to the V&V Repository for the Contractor Test Cost Proposal Review guidance.

The DT and OT Test Directors and test team members assist in developing technical evaluation criteria that will be used to evaluate vendor proposals to the SIR. For COTS and/or NDI equipment procurements, the FAA may institute and conduct a "try before you buy" product review in the technical evaluation segment. This evaluation approach is conducted within the scope of either an OCD or an OCT. For either approach, prospective equipment vendors develop their proposals based on evaluation criteria defined within the SIR.

6 T&E SUPPORT TO SOLUTION IMPLEMENTATION - DT

T&E support to SI begins with the Development Test (DT) phase of the T&E program. The primary objective of DT is to demonstrate that all specified technical and performance requirements for a system or service have been met. Another objective is to verify that the system or service is fully integrated and stable, and that it has no adverse effect on the rest of the NAS. It may include one or more demonstrations to ensure that the system meets user and operational requirements. DT is performed by the development contractor and witnessed by the ANG-E DT Test Director and DT test team. DT activities may also be monitored by IOA personnel. These test activities can be conducted at the contractor's facilities, the FAA William J. Hughes Technical Center (WJHTC), and/or FAA field sites.

This section of the handbook describes the processes necessary for DT planning, conduct, and reporting. Additionally, Appendix D identifies the major DT work products along with their associated review and approval cycles.

6.1 DT OVERVIEW

This section of the handbook describes the processes and best practices to be followed to help ensure a successful DT, which may include:

a) Government or private laboratory testing, or

b) Site Acceptance Testing (SAT), whether conducted by Government personnel or a contractor under Government scrutiny.

DT encompasses all testing necessary to verify contractual requirements and is performed at FAA-approved contractor facilities, FAA laboratories, or FAA field sites. After DT, the FAA will accept the portion of the system demonstrated through a formal Government Acceptance (GA) process.

As shown in Figure 3-1, there are two types of GA: the first type pertains to the acceptance of systems at the WJHTC; the second type involves the acceptance of systems at field sites, as illustrated in Figure 6-2.

6.1.1 DT TEST ACTIVITIES

The DT process will differ from program to program, depending on size and complexity. It should progress from verifying requirements at the unit level (lowest component) and move incrementally to the fully integrated, fielded system level.

The following items define the standard test activities (which may be modified based on program needs) for DT:

a) DT Software Testing: Verification of the specifications at the B-Level (subsystem). DT Software Testing usually addresses new and modified software broken down to the Computer Software Configuration Item (CSCI), Computer Software Component (CSC), and functional design components.

b) DT Hardware Testing: Verification of the specifications at the B-Level. DT Hardware Testing usually addresses new and modified hardware broken down to the Hardware Configuration Item (HWCI) and Hardware Design items.

c) Factory Acceptance Testing (FAT): Verification of primarily hardware, firmware, and Commercial Off-the-Shelf (COTS)/Non-Developmental Item (NDI) subsystem components to address B-Level and A-Level (system) specification items.

d) Functional Qualification Testing (FQT): Verification of partially integrated hardware and software subsystem components, including COTS/NDI and modified COTS/NDI subsystem components, to address B-Level and A-Level specification items.

e) DT Integration Testing: Verification of proper installation and functioning of the complete system in the laboratory environment, including the verification of system interfaces with other NAS equipment and Government Furnished Equipment (GFE).

f) DT System Testing: Verification of integrated software and hardware components to address A-Level specification items under conditions that emulate the projected operational conditions.

g) Production Acceptance Testing (PAT): Verification of production line units of developed hardware prior to installations at field sites to address B-Level and some A-Level specification items.

h) Site Acceptance Testing (SAT): Verification of fully-integrated software and hardware components to address A-Level specification items that could not be tested sufficiently during DT System Testing. SAT also demonstrates that the requirements that were verified under DT System Testing continue to remain in conformance as installed at the operational field site by executing a subset of the DT System Tests.

i) DT Regression Testing: Verification of integrated software and hardware components after changes to either have been made based on anomalies discovered during previous DT test activities. DT Regression Testing also ensures that the changes made did not inadvertently result in a problem elsewhere in the system.

6.1.2 DT TEST REQUIREMENTS

DT verification is based on contractually-required activities that the prime contractor must perform to demonstrate conformance to the FAA-developed system specifications. The prime contractor may develop and maintain separate specifications that are derived from the FAA specifications and approved by the FAA as a CDRL document. The FAA- developed system specifications or the contractor system specification (A-Level) is the "test to" document that drives the conduct of DT. The prime contractor and associated subcontractors may develop subsystem specifications (B-Level) and design documents that form the basis for B-Level verification and system level procedure development.

The DT Test Director and test team review the contractor's test CDRL documentation and witness all tests during DT. The DT Test Director reviews the team's comments and recommends Government approval or disapproval to the Contracting Officer (CO) and Contracting Officer's Representative (COR). The DT test team must be proficient in their particular program domain (e.g., Communications, Navigation, Surveillance, Weather, and Air Traffic Automation) and eventually become experts on the system under test. System expertise is necessary to ensure that the tests performed by the system contractor are valid and comprehensive.

The DT functional flow diagram depicted in Figure 6-1, FAA DT Process Flow, identifies the tasks and functions that support DT from the Screening Information Request (SIR) through delivery of the DT Final Test Report. The tasks and functions that support SAT, from generation of the SAT Plan through the start of Field Familiarization (FF), are identified in Figure 6-2, SAT Process Flow.

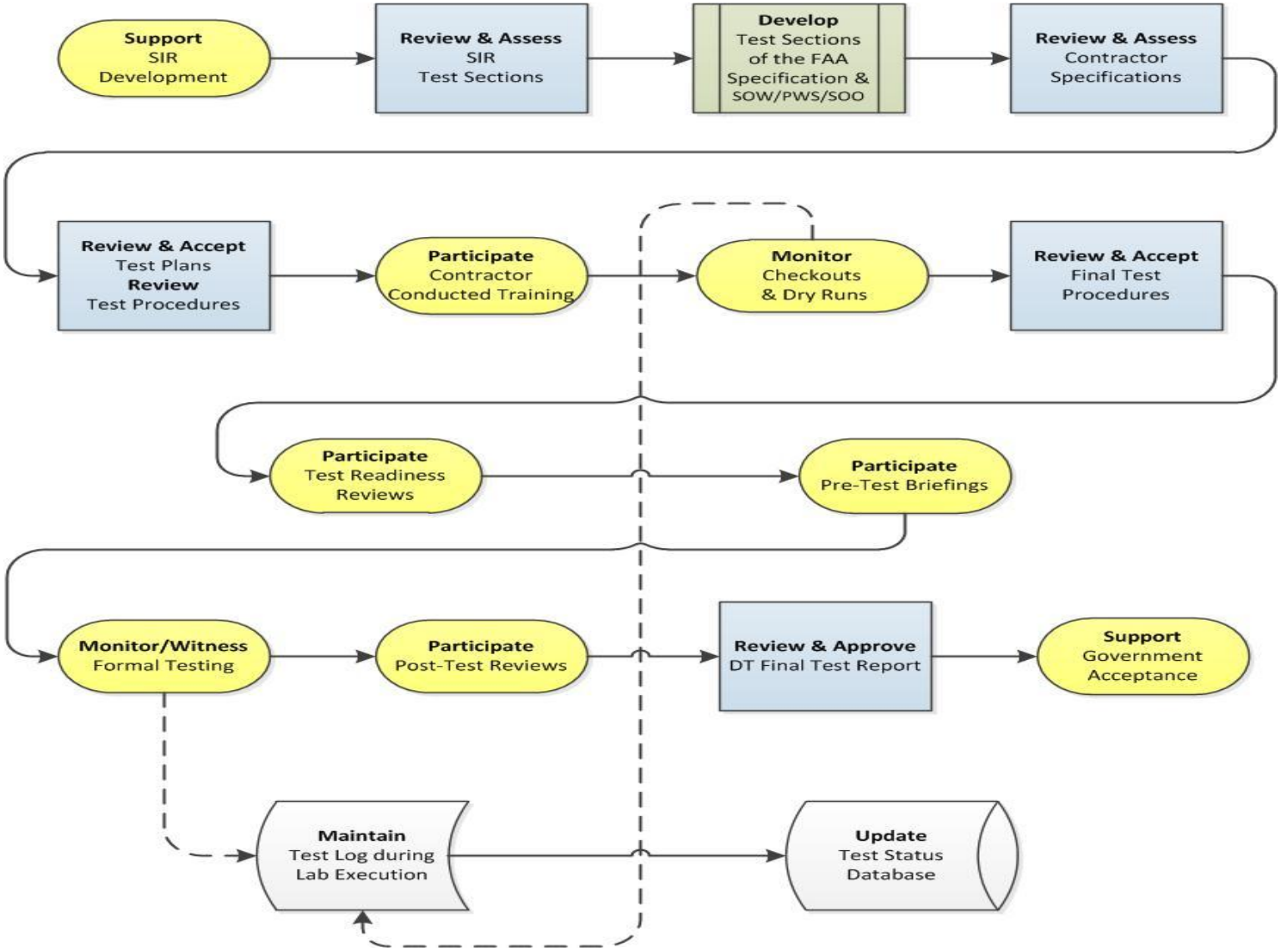

FIGURE 6-1. FAA DT PROCESS FLOW

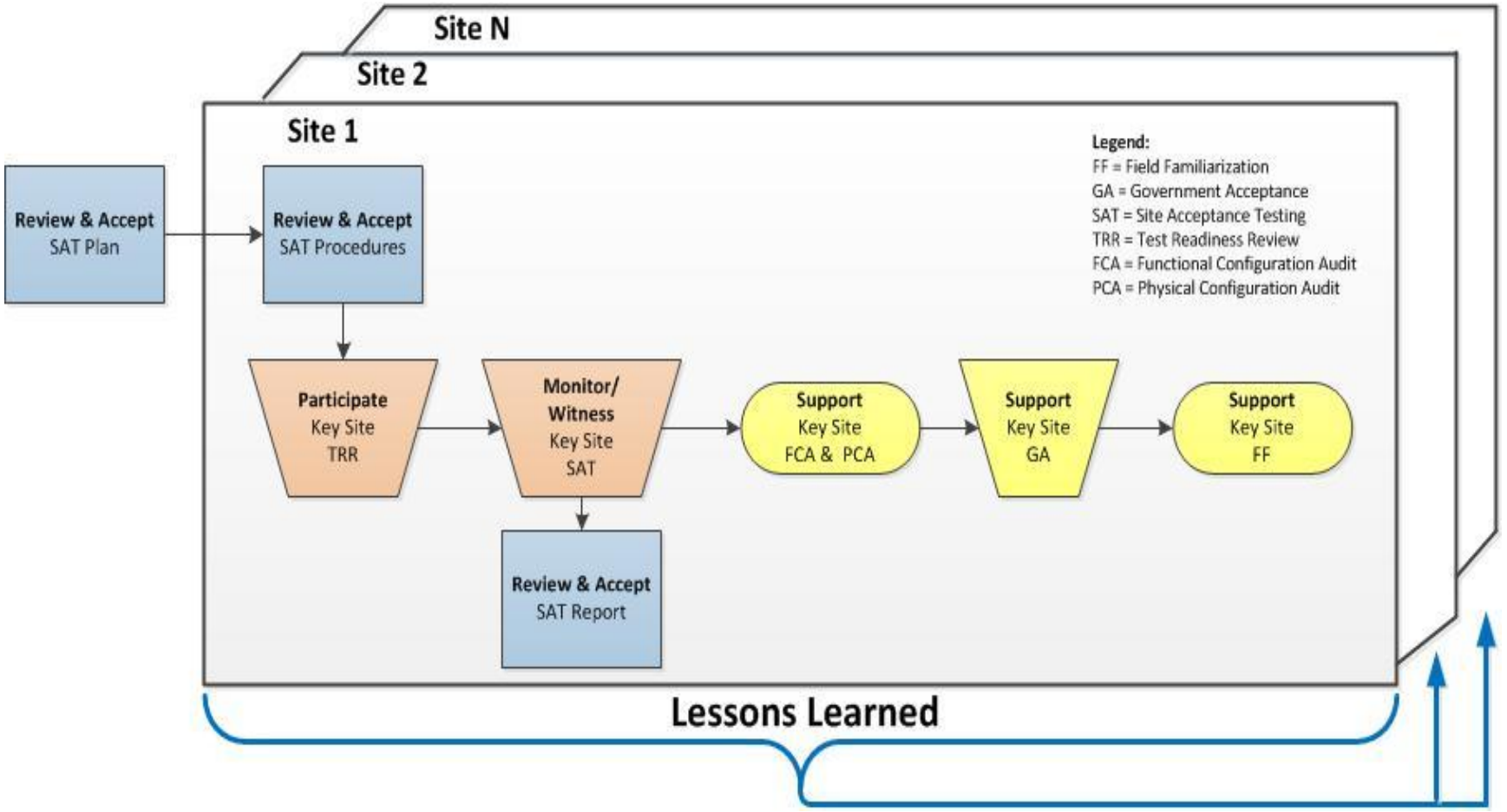

FIGURE 6-2. SAT PROCESS FLOW

6.1.3 DT SUPPORT TO CONTRACT ADMINISTRATION

The DT Test Director and DT test team coordinate with the CO and the COR to provide support in the following areas:

a) Negotiating the test cost and schedule baseline prior to contract award.

b) Tracking the contractor test cost and schedule performance measured against the baseline. This includes reviewing documents delivered by the contractor to the FAA (usually monthly) that detail the cost and schedule status of the program.

c) Participating with the Program Office in occasional Integrated Baseline Reviews (IBRs). The IBR is a formal meeting between the FAA and the contractor to ensure that the program is staying within the program baseline.

d) Participating in additional negotiations when changes are made to the contract cost and schedule baseline to determine a new test cost and schedule baseline.

e) Reporting test program status and changes in the test program.

f) Developing the contract, including modifications to criteria and contract line items that pertain to T&E.

g) Addressing test issues that could affect the cost and schedule baseline.

h) Reporting the results of tests and the disposition of test document deliverables.

i) Evaluating acceptability of test-related contract conformance/deliverable items.

j) Deciding to award incentives based on test-related milestones.

k) Deciding GA after DT and SAT.

l) Reporting on minutes or issues from the Test Working Group (TWG) as required.

m) Conducting the Functional Configuration Audit (FCA) and Physical Configuration Audit (PCA).

n) Assisting the FAA Quality Reliability Officer (QRO) in GA activities.

6.1.3.1 DT SCREENING INFORMATION REQUEST SUPPORT

To ensure that the contractor's test program meets the program goals, the DT Test Director works with the OT Test Director to develop T&E requirements for the SIR. The SIR includes a description of work requirements (e.g., Statement of Work (SOW), Performance Work Statement (PWS) or Statement of Objectives (SOO)) for the contractor's proposal. See Section 5.5 for a detailed description of DT SIR support requirements.

6.1.3.2 CONTRACTOR DOCUMENTATION SUPPORT

The FAA specifies the necessary documentation that the contractor must deliver in accordance with the FAA AMS. The DT Test Director ensures that the test Data Item Description (DID) requirements and the test CDRL documents are consistent with the test sections of the SOW or PWS.

The DT Test Director recommends the schedule for delivery of test documentation by the contractor. This schedule includes the amount of time that the FAA has to review and comment

on the documents, typically 30 days. The schedule includes a time period for the contractor to incorporate comments and redeliver the document to the FAA, typically no less than 15 days.

Prior to submitting formal draft or final CDRL documents to the FAA, the contractor must conduct internal peer reviews and provide evidence (i.e., a documented record) of the reviews to the FAA. These reviews help ensure that the documents fully reflect the contractor's technical and programmatic approach for satisfying the Government requirements. The contractor must conduct draft reviews of CDRL documents with the FAA prior to delivering the final document. This review is conducted to ensure that all FAA comments are clear and to verify the context in which the contractor intends to incorporate comments.

The minimum test documentation for any procurement consists of the following:

a) CMTP

b) DT VRTM (may be contained in the CMTP, DT Test Plan(s), or in a separate CDRL document)

c) DT Test Plan(s), Test Procedures, and Test Report

d) Integration and Test Development Plan (ITDP) and Report (as required)

e) Other contractor documentation that may be required and that impacts T&E, including:

   1) CM Plan

   2) Software Development Plan

   3) Reliability, Maintainability, and Availability (RMA) Test Report(s)

The contractor must perform internal peer reviews of these documents prior to submission to the FAA.

6.1.3.3 CONTRACTOR TEST DOCUMENT REVIEW STANDARDS

The DT Test Director and test team review and comment on all contractor-delivered test documents. The Test Director provides comments and recommendations (approval/disapproval) on the test documents to the CO and COR. The following guidelines should be used in document review:

a) Ensure that the test team is familiar with the system design, NAS integration environments, and general NAS architecture prior to reviewing the test plans and procedures.

b) Ensure that the contractor has developed the DT VRTM based on the FAA System Specification in accordance with the terms of the SOW/PWS.

c) Ensure that the approved DT VRTM has been delivered prior to the FAA reviewing the test procedures.

d) Review the documents for technical content and compliance with the applicable DID.

e) Ensure that test documents are consistent with all relevant requirements and contain clearly defined test objectives and success criteria.

f) Ensure that all interested parties receive CDRL documents with sufficient time for a comprehensive review.

g) Collect comments from test team document reviews. Ensure that FAA comments are clear, detailed, specific, and based on compliance with FAA requirements. Consolidate and submit comments by the due date.

h) Reject the deliverable if it does not meet contract requirements and standards. Technical directions, as approved and conveyed through the Contracting Office, are provided to the contractor to rectify the shortcomings of the deliverable.

i) Use a database, when practical, to manage comments for delivery to the contractor.

Note: Refer to the V&V Repository for the DT Comment Form template.

6.1.3.4 FCA, PCA AND GA ACTIVITIES SUPPORT

The DT test team supports the PCA and the FCA. The PCA is the formal examination of the "as-built" configuration against its technical documentation to establish or verify the product baseline. The FCA is the formal examination of functional characteristics, prior to GA, to verify that the item meets the requirements specified in its functional configuration documentation. DT test results acquired from formal test documentation are used to ensure that a system or part of a system successfully passes the PCA and FCA. The DT Test Director provides the FAA test expertise for the PCA and FCA.

The DT test team may also support the FAA QRO in the GA process by reviewing and assessing the accuracy of requirements verification status, system issues, and the disposition of problems reported by the contractor.

6.1.4 DT ENGINEERING SUPPORT

The DT test team participates in system engineering meetings and activities held by the Program Office to provide test expertise. This participation includes meetings and events between the FAA and the system contractor (e.g., System Engineering Working Group (SEWG) meetings) and internal FAA-only activities and meetings.

The DT test team participates in hardware and software design meetings and reviews with the contractor. This support includes reviewing contractor-developed engineering change request documentation and hardware/software documentation. Through this activity, the DT test team provides test engineering services for the evaluation of test results from software and hardware redesigns.

6.2 DT TEST PLANNING

To ensure successful test planning and execution, the DT Test Director communicates regularly with the Contractor Test Manager. In the early part of the contract, the DT Test Director and Contractor Test Manager work closely together to define a comprehensive test program.

Early planning tasks involve defining the strategies for:

a) Developing and maintaining the DT VRTM

b) Overall test approach and breakdown

c) Tools, simulations, and test environments

d) Developing and managing test laboratories

e) Providing resources required for testing

f) System integration

g) Tailoring of standard test processes

h) Contractor test management

i) Informal and formal test conduct

To ensure that test issues are formally discussed and resolved with the contractor, a TWG is established. This working group is co-chaired by the DT Test Director and the Contractor Test Manager. The membership also includes the DT test team members, Program Office representatives, system users, the OT Test Director, and the OT test team members. The meeting schedule for the TWG is established during test planning. The first meeting is held prior to the first formal design review. The contractor, as required, records and maintains the minutes and actions items from the TWG meetings.

6.2.1 DT TEST APPROACH AND STRATEGIES

The approach and strategies for a successful DT must apply the test activities previously identified in Section 6.1.1 to address program needs. Not all test activities are required for every program. The program complexity, system impacts, and scale of development will scope the level of testing in the DT test approach and strategies. A progressive and measured approach is the best way to address T&E standards. During DT, requirements must be verified starting at basic component levels, and incrementally building to complex integrated component levels.

During DT, the test environment can differ between the contractor's facilities, a field site, or a laboratory at the FAA WJHTC. During the test planning period, the test environment for each test is determined. The test environment must mimic, as close as possible, the actual operational environment of the system at the field site. Also, formal configuration control of the test environment must be maintained throughout DT.

6.2.1.1 COTS/NDI TESTING

DT must account for the use of COTS products and NDIs in the test program. The test method for these items is determined by the DT Test Director. Items that have undergone adaptation, customization, or protocol modifications require specific testing and/or demonstration of the modified elements. The integration of these items with the other NAS subsystems must be tested or demonstrated, or both. If the items or their integration is specialized or used for the first time in this application, then special testing will be necessary. When planning COTS/NDI testing, it is important to identify, consider, and report all associated risk factors (see the FAA System Engineering Manual (SEM) for guidance on the implementation of COTS products and NDIs).

COTS/NDI hardware, software, and firmware items that are not modified or customized can be tested through screening. Data from COTS/NDI screening is used whenever possible as the sole means of testing requirements or in conjunction with DT test activities. Screening of these items can consist of the following FAA reviews to support verification:

a) Assessment of vendor specification, design, and production processes

b) Inspection of visual attributes

c) Participation in demonstrations of performance, environmental, and suitability characteristics

d) Evaluation of maintenance support provisions and warranties

e) Functional integration testing (as required) to assess COTS/NDI functionality as integrated with other COTS, NDI or NAS subsystems

6.2.1.2 DT SOFTWARE TESTING

DT Software Testing is primarily conducted to verify the requirements that are at a lower level (B-Level) than system level requirements. DT software requirements are documented in contractor software requirement specifications or related design documents. This testing is conducted by the developing contractor and witnessed or monitored by the FAA. Testing may occur at a vendor facility, contractor facility, or the FAA WJHTC in accordance with the approved CMTP.

DT Software Testing should include or address the following:

a) The contractor must report the status of testing activities and requirements verification status at the DT TWG meetings.

b) As part of the software development, the contractor must maintain CSCI Integration Files/Folders (CIFs). CIFs must be sufficiently detailed to support independent evaluation of the contractor's CSCI testing plans, status, and verification results. CIFs must minimally include, in contractor format, test plans/procedures, test logs, as-run procedures, and data recording and analysis.

c) The contractor must make CIFs available to the Government for review.

d) The verification of a subset of system level requirements may occur during DT Software Testing. These system level requirements will be verified in either of the following ways:

   1) The system level requirement is directly verified at the non-system level by the execution of DT Software Test steps.

   2) The system level requirement is verified through inspection and analysis of the results of the DT Software Testing for specific related non-system level requirements.

The success criteria for the associated non-system level requirements must be included in the delivery of system level success criteria. The FAA review of these non-system level requirements will follow the same process as for the system level requirements.

Verification of system level requirements through CSCI testing must be documented in a DT VRTM.

6.2.1.3 DT HARDWARE TESTING

DT Hardware Testing is conducted at the unit and/or subsystem level for programs that require contractor-developed hardware. This testing is conducted by the developing contractor and witnessed or monitored by the FAA. The formal DT Hardware Testing requires hardware test plans, procedures, and reports at the unit and/or the subsystem level. In addition, the

manufacturing process used to develop the hardware needs to be qualified via testing. When a significant quantity of hardware items is to be produced, only a representative subset of the produced hardware is subject to test.

DT Hardware Testing focuses on the following areas:

a) Verifying that the hardware conforms to applicable specifications, is free from manufacturing defects, and is substantially identical to qualified hardware (only for PAT)

b) Evaluating the manufacturing process for newly developed hardware.

c) Testing of COTS/NDI products

d) Testing the hardware in the racks or assemblies to be fielded

e) Testing the interfaces between Line Replaceable Units (LRUs). This interface testing can be conducted using special test software, operational software, or both

f) Electrical power testing

g) Thermal testing

h) Acoustic testing

i) Electromagnetic Interference (EMI)/ Electromagnetic Compatibility (EMC) testing

j) Seismic, shock, and vibration testing

6.2.1.4 FACTORY ACCEPTANCE TESTING (FAT)

FAT is performed at the subsystem or partially integrated system level to verify some system level requirements, non-system level software requirements, and hardware subsystem requirements. FAT may also provide for the final verification of A-level requirements that do not require the final baseline environment. FAT is conducted in accordance with the CMTP and the SOW/PWS. FAT may be conducted at a contractor's facility or at the FAA WJHTC.

The following items should be considered when planning for FAT:

a) FAT is a prerequisite to DT System Testing

b) The contractor obtains Government concurrence of the success criteria

c) FAT plans, procedures, and reports are CDRL deliverables that are approved by the FAA

d) The FAA test team will witness FAT activities

e) The test executions are conducted on a configuration-managed baseline

6.2.1.5 FUNCTIONAL QUALIFICATION TESTING (FQT)

FQT is conducted on programs that have a vendor or subcontractor under contract to the prime contractor for delivery of a product or subsystem. FQT demonstrates capabilities to integrate with the NAS through the use of drivers and simulators, where applicable.

Prior to DT System Testing, the prime contractor directs associate subcontractors to perform FQTs in accordance with the CMTP, the FAA contract SOW/PWS, and the prime contractor/subcontractor SOW/PWS. FQT may be conducted at the vendor/subcontractor

facility, contractor facility, or the FAA WJHTC. The FAA will monitor the prime contractor and subcontractor on all FQT activities.

The following items should be considered when planning FQT:

a) The prime contractor plans and approves all FQT activities

b) All FQT Test Plans, Test Procedures, and Test Reports are to be provided to the Government for review

c) FQT verifies product specification requirements associated with the subsystem delivered by the subcontractor

d) The prime contractor utilizes the requirements from the product specification to address and provide traceability to the FAA system specifications

e) FQT plans, procedures, and reports are formal deliverables to the prime contractor, but must be made available to the FAA for review

f) All pertinent test data will be collected and logged in accordance with the approved Quality Assurance (QA) processes

g) FQT may not be subjected to all of the formal FAA processes as other DT activities since it is under the auspices of the prime contractor

6.2.1.6 DT INSTALLATION AND INTEGRATION TESTING

To ensure an efficient process, DT Installation and Integration (I&I) Testing is scheduled early in the development of a system and made a prerequisite to DT System Testing. Early integration testing is effective in finding low-level issues that might have been overlooked if this testing was not conducted. For systems where the integration process is complex, specific integration milestones are required.

The installation and integration of the hardware and laboratory environments to be used during system tests must be verified through DT I&I Testing prior to conducting DT System Testing. DT I&I Testing ensures that the system is properly installed and functioning, correctly interfaced with GFE, and ready to begin DT System Testing. It includes hardware and NAS integration test activities. The FAA will witness all DT I&I Testing conducted by the contractor.

6.2.1.7 DT SYSTEM TESTING

DT System Testing verifies the system's ability to satisfy the requirements of the applicable system specifications assigned to the contractor. The FAA will witness all DT System Testing conducted by the contractor. System test plans, procedures, and reports are deliverables that are approved by the FAA. System test areas can include:

a) Integration and Interface Verification: The verification of subsystem integration and NAS interfaces.

b) System Capacity and Response Time Performance Verification: The verification of system processing time and stress thresholds.

c) Failure Mode and Failure Recovery Verification: The verification of failure mode conditions and system recovery capabilities.

d) Stability Verification: The verification of system performance under extended continuous system use.

e) Reconfiguration Verification: The verification of system reconfiguration capabilities.

f) Functional Verification: The verification of functional performance with a fully integrated system and realistic NAS data.

g) Site Simulation Verification: The verification of system performance under simulated or real operational site conditions and configurations.

h) System Support Functional Verification: The verification of system support functions with a fully integrated system required by the FAA WJHTC laboratories and the sites.

i) Monitoring and Control Verification: The verification of required system monitoring and control functions with a fully integrated system.

j) Security Test: The verification of the security requirements. Coordinate these tests with the development of the Security Certification and Authorization Package (SCAP) to avoid duplication of effort.

k) Acceptance Test: The verification of the fully assembled and fully integrated system that addresses a sampling of all aspects of system functional performance requirements. This test may provide the foundation for regression testing and SAT.

l) Reliability Verification: The verification by analysis, consisting of reliability predictions supplemented by data collected during system level verification.

m) Maintainability Demonstration: The demonstration of an approved subset of the maintainability requirements.

n) Electromagnetic Interference and Electromagnetic Compatibility Verification: The verification of EMI and EMC requirements.

o) Power Quality Testing: The verification of power quality testing requirements.

p) Simulation: Tests using simulated interfaces or subsystems are valid to verify requirements.

System testing often requires the use of both live and simulated interfaces and subsystems. The use of live and simulated data should be used as complementary test methods. Live data provides for the most relevant observation of how the system performs. However, live data may lack repeatability of test results (which may be overcome by the recording and playback of live data). Simulations provide for repeatability and the generation of conditions that are cost prohibitive or impractical with live data (e.g., capacity scenarios, interference, etc.). Simulations attempt to mimic live stimuli to a system but are not an exact replication. Minor shortfalls in simulation fidelity have been observed in practice to have a significant impact on test results (e.g., the system works in simulation but is operationally deficient in practice). Therefore, optimal system testing is often accomplished using a combination of live and simulated interfaces and subsystems. Simulations must be accredited (see Section 9.1) prior to the formal conduct of tests using the simulation.

Prior to entering DT System Testing, a System Test Entrance Checklist is completed by the DT Test Director as an internal FAA assessment of DT issues and test readiness. This checklist is

submitted to the Test Standards Board (TSB) for their review and comment and must be endorsed by the T&E First Line Supervisor prior to the Test Readiness Review (TRR) (see Section 6.3.2).

Note: Refer to the V&V Repository for the DT System Test Entrance Checklist template.

6.2.1.8 PRODUCTION ACCEPTANCE TESTING (PAT)

The contractor performs PAT on newly manufactured hardware items to verify that the hardware items and installed software or firmware conform to applicable specifications. This testing also verifies that the production unit is free from manufacturing defects and is substantially identical to qualified hardware. Government personnel will witness the contractor's PAT. The contractor will develop PAT Test Plans, PAT Test Procedures, and PAT Test Reports.

6.2.1.9 SITE ACCEPTANCE TESTING (SAT)

SAT verifies the site installation, system integration, and operational configuration of the system and that the system complies with contractual requirements. All requirements designated by the DT VRTM for verification during SAT must be verified. SAT is conducted at each Government facility where the system is installed. Ensuring the quality of installation procedures is also part of SAT. SAT is conducted by the contractor and is witnessed by the FAA. The DT test team reviews the SAT Test Plan and Test Procedures. SAT differs from other aspects of DT in that it focuses on performance with respect to a specific location. SAT verification addresses requirements that need operational site conditions and configurations not available during formal DT System Testing activities.

The following items must be addressed when planning for SAT:

a) A specific individual is designated as the Site Test Director to be the FAA Lead for SAT activities and formally accept test results. Other personnel may be designated as Alternate Site Test Directors to represent the site in the absence of the Site Test Director.

b) The DT test team coordinates with each facility prior to SAT. Meetings are held with the Site Test Director well in advance of any test activities. This allows for logistical coordination and helps to familiarize site personnel with the product, test process and roles.

c) The DT test team coordinates all site test support activities with the Site Test Director or designee.

d) The DT test team coordinates with the sites regarding the schedule and scope of the SAT for each location.

e) SAT documentation must be delivered to the Site Test Director for review and comment. Enough time must be provided to the Site Test Director to perform the review and comment.

f) SAT uses a subset of DT requirements to determine fully acceptable system implementation at each site.

g) One or more "Key Sites" is/are designated as the first location(s) in the system site deliveries. More than one Key Site may be necessary to verify system performance, depending on the scope of the tests. Some considerations in determining a Key Site include:

   1) Amount of support available from site personnel to resolve issues found during testing.

   2) Experience of the site personnel in managing the planned testing.

   3) Ability to coordinate and document facility procedures, and plan for use by subsequent sites.

   4) Location has a low risk for Air Traffic Control (ATC) safety impacts during system integration at the site.

   5) Representative field conditions and environment.

   6) Available operational interfaces.

h) The AMS T&E Guidelines recommends that Key Site SAT be conducted following the completion of formal OT. However, if a test program is designed to verify a significant number of system specification requirements at the Key Site, the Key Site SAT should be planned for completion prior to the start of formal OT.

Systems often must be adapted depending on where the system is deployed. The contractor, with FAA approval, identifies which parameters are site-specific and ensures those parameters are included in the software and hardware delivered to the site. Though CM is critical throughout the test program, precautions are taken to ensure that site-specific data is correct. The contractor briefs the site personnel on the configuration of the system prior to SAT at the TRR and Pre-Test Briefing. These configurations are verified by the QRO and DT test team prior to formal test conduct.

6.2.1.10 DT TEST CAPABILITY ACCREDITATION

DT test capabilities must be accredited in accordance with Section 9.1.

6.2.1.11 COORDINATION BETWEEN DT AND OT TEST DIRECTORS

The DT and the OT Test Directors coordinate on test strategies throughout the lifecycle of the system. This coordination begins with the Integrated Test Team (ITT) when the TEMP is developed and continues through the TWGs.

To reduce the risk of encountering major system problems during OT, the DT Test Director should incorporate operational conditions and conduct evaluations from an operational perspective. To accomplish this, both the DT and OT Test Directors must ensure that operationally oriented test conditions and evaluation criteria are planned for by addressing them appropriately in the SIR, SOW/PWS, CMTP, and system specification.

6.2.1.12 DT TRAINING AND FAMILIARIZATION

The DT Test Director is expected to be an expert in the domain for the program in which that person leads. However, T&E specific training and qualification are required for each DT Test Director. This training ensures that the DT Test Director understands the policies and processes related to T&E.

The DT test team receives two types of training:

a) Training on system operations and functionality, provided by the contractor as required by the SOW/PWS. Also, the DT test team can become familiarized through participation in the oversight of the system development by the contractor.

b) T&E Handbook and QMS process (see Section 1.8) training to ensure that T&E practitioners fully understand what is expected to successfully perform the DT Test Program.

6.2.2 CONTRACTOR MASTER TEST PLAN

The CMTP describes, at a high level, the contractor's complete test approach for the system acquisition program. Information in the CMTP includes:

a) Test Management

b) DT VRTM

c) Identification and definition of major test areas

d) Test tools and accreditation plans for test capabilities

e) Test environment

f) Integration testing

g) Schedule (based on the overall program schedule)

h) Configuration Management

i) Tracking and verification of safety requirements (includes system safety and personnel safety during tests)

j) Security (Coordinate these tests with the development of the SCAP to ensure that requirements are addressed)

k) Process description

l) Requirements tracking

m) COTS/NDI test strategy

n) Testing of interfaces to the NAS

o) Program Trouble Reporting and corrective action process (see Section 6.3.7)

p) Initial system certification (not applicable on all programs)

Note: Refer to the V&V Repository for the CMTP template and a CMTP sample.

The DT test team conducts an early informal review of the CMTP with the contractor in order to discuss test strategies and issues in a collaborative environment. This collaboration will ensure that the contractor's and FAA's test planning is in agreement and that the CMTP is contractually adequate and compliant. Subsequently, the DT test team and the TSB review the revised CMTP prior to the DT Test Director's recommendation for approval by the CO.

Refer to Appendix D, Figure D-4, for the complete CMTP review and approval cycle.

For planning purposes, the CMTP can be required as early as Contract Award to as late as 30 days after the Critical Design Review (CDR). Generally, if the product is COTS or an NDI, the CMTP would be required sooner (i.e., towards Contract Award) rather than later. For development products, general guidance would be based on the maturity level of the product or the technology. For example, a development program using a proven technology may require the CMTP to be delivered at the System Requirements Review (SRR) or no later than the Preliminary Design Review (PDR). Consequently, a development project with an experimental technology or other high risk may require a draft CMTP to be delivered at PDR and a final CMTP at CDR. To summarize, using sound engineering judgment based on the product's maturity level is the best guidance for required delivery of the CMTP.

6.2.3 DT VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (VRTM)

The DT VRTM summarizes how each requirement is verified. It includes a reference to a specific requirement, a short description of the requirement, the type of verification method that the contractor performs to show that the requirement is satisfied (Demonstration, Test, Analysis, or Inspection, as defined in Section 5.3.3.5), and the DT activity during which the requirement is verified.

The initial DT VRTM is developed based on system level requirements contained in the FAA System Specification in accordance with the terms of the SOW/PWS. Lower level DT VRTMs are established and documented during the planning for hardware and software testing.

The baseline DT VRTM is contained in an appendix to the approved CMTP. Subsequent changes to the DT VRTM do not require a resubmission of the entire CMTP. Instead, the contractor can deliver formal updates via a revised CMTP appendix as a contract correspondence that requires FAA approval. Additionally, during DT Test Plan development, the contractor will refine the DT VRTM with test case information and will include the updated DT VRTM as part of or an attachment to the DT Test Plan(s).

In addition to test case mapping, the DT VRTM includes success criteria. Success criteria are developed for each contract specification requirement and describe the objectives that must be met for the successful verification of the requirement. Success criteria are measures of a system task's accomplishment and/or system characteristics, as well as measures of operational capabilities in terms of the system's ability to perform its mission in an operational environment. The success criteria are generated by the contractor through a detailed analysis of requirements and provided to the FAA for concurrence prior to the start of each final test execution. Once FAA concurrence is provided, the contract specification requirements are statused against the established success criteria during DT testing. Any changes to the established, agreed-upon success criteria normally require agreement in writing by the FAA and contractor, with updates incorporated into the DT VRTM.

Note: Refer to the V&V Repository for the VRTM template.

6.2.4 DT INTEGRATION TEST PLANNING

During a typical system development, hardware and software items are developed separately. The integration of the hardware and software begins when both of these items reach a sufficient level of maturity.

For large integration efforts, the prime contractor must prepare and maintain an Integration and Test Development Plan (ITDP). This plan describes the product integration approach and criteria, the activities for developing test procedures, and the methods and schedules for implementing and controlling the integration and test development programs. Since this testing may not be the final or full verification of the system requirements, specific criteria and measures must be established and documented to plan for successful DT Integration activities. If a separate ITDP is not required, the integration testing approach can be documented in the CMTP.

The following items must be considered when planning for DT Integration Testing:

a) Plans must measure progress and contain sufficient criteria to determine if the system or service is ready to move on to the next DT activity.

b) Prior to an integration activity, entrance criteria must be identified and documented. Entrance criteria provide an objective measurement of what needs to be in place, with all dependencies clearly identified.

c) Exit criteria must be identified and documented. Exit criteria provide objective measurements of what each activity is to accomplish, ensuring an orderly progression of activities and demonstrating that system maturity is increasing to a successful acceptance of the system.

d) Milestones related to the type of configuration, system loads, complexity of configurations, duration of test run times, and variations of interfaces must be defined to indicate system maturity and the progress of the system integration.

e) The test configurations required to perform integration testing must be defined in the ITDP or CMTP.

6.2.5 DT TEST PLANS

DT Test Plans provide more detail than the CMTP regarding DT for the test areas identified in the CMTP. A DT Test Plan is developed by the contractor for each of the DT test activities (e.g., SAT Test Plan, FAT Test Plan, Integration Test Plan, etc.). DT Test Plans cover all aspects of DT in proper detail so that the DT Test Procedures can be written from test descriptions contained in the DT Test Plan.

A DT Test Plan contains the following key elements:

a) DT test program management

b) Schedule (based on the overall program schedule)

c) Test descriptions

d) Plans and itemized lists for required GFE, Government Furnished Information (GFI), and Government Furnished Property (GFP)

e) Program Trouble Reporting and corrective action process (see Section 6.3.7)

f) Configuration Management

g) DT VRTM

h) Accreditation plans for test capabilities

Note: Refer to the V&V Repository for the DT Test Plan template and a DT Test Plan sample.

Similar to the review and approval process described in Section 6.2.2 for the CMTP, the DT test team conducts an early informal review of the DT Test Plan with the contractor in order to discuss test strategies and issues in a collaborative environment. This collaboration will ensure that the contractor's and FAA's test planning is in agreement. Subsequently, the DT test team and the TSB review the revised DT Test Plan prior to the DT Test Director's recommendation for approval by the CO.

Refer to Appendix D, Figure D-5, for the complete DT Test Plan review and approval cycle.

6.2.6 DT TEST PROCEDURES

The DT Test Procedures are developed by the contractor based on their respective DT Test Plan(s). The Test Procedures include all of the details for conducting a particular test to verify requirements as specified in the respective Test Plan(s). These details include:

a) Tables of step-by-step instructions to run the test

b) Observations to be made during the test

c) Expected results

d) Objectives

e) Success criteria

f) Test limitations

g) GFE, GFI, and GFP required for the specific test

h) Notations of the requirements being tested by a particular test and step

i) Data collection, reduction, and analysis required

j) Test tools and equipment required

k) Configuration of the system under test and the test environment

The DT test team reviews the DT Test Procedures and provides comments to the contractor for disposition. Once the dispositions of comments are agreed to by both the FAA and the contractor, the DT Test Director recommends approval or disapproval of the document to the CO and COR. The test procedures are then executed via dry run testing (see Section 6.3.1) prior to formal test conduct.

Refer to Appendix D, Figure D-6, for the complete DT Test Procedures review and approval cycle.

Note: Refer to the V&V Repository for the DT Test Procedures template and a DT Test Procedures sample.

6.2.7 DT ENTRANCE CRITERIA

Prior to entering any formal DT test activity, the DT Test Director ensures that the following minimum DT entrance criteria are met:

a) All entrance criteria as defined in the approved CMTP and DT Test Plan(s) are satisfied

b) DT Test Procedures have been submitted, reviewed, and approved

c) The test configuration is known and documented

d) Dry run testing has been completed by the contractor

e) The configuration under test does not have known deficiencies that affect the functions to be verified by the test

f) If required, test capability accreditation has been conducted and approved

6.2.8 DT EXIT CRITERIA

Prior to exiting any formal DT test activity, the DT Test Director ensures that the following minimum DT exit criteria are met:

a) All exit criteria as defined in the approved CMTP and DT Test Plan(s) are satisfied

b) Completion of all DT tests in accordance with approved Test Plans and Test Procedures

c) All Post-Test Reviews are complete

d) Test results are documented and accepted by the FAA

e) All DT Program Trouble Reports (PTRs) are fully documented, assessed, and statused

f) All contractor performance requirements are addressed in accordance with the contract

6.3 DT TEST CONDUCT

For all DT testing, the DT Test Director ensures that the contractor performs testing in accordance with the SOW/PWS and approved Test Plans and Procedures. The DT Test Director also ensures that the DT test team is prepared to witness the tests. The contractor conducts debug and dry run testing followed by a TRR prior to each formal DT test activity. The DT Test Director ensures that the minimum DT entrance criteria as defined in Section 6.2.7 have been met.

The DT Test Director and/or the test lead must report and record the status of all test activities. Following each formal DT test activity, the DT Test Director ensures that the minimum DT exit criteria as defined in Section 6.2.8 have been satisfied.

6.3.1 DT DEBUG AND DRY RUN TESTING

Prior to formal DT testing, debug and dry run testing of the procedures must be performed. Debug testing is where test procedures are executed against the system under test to ensure that

the test steps are correct, complete, and produce repeatable expected results. During this testing, the procedures are refined and updated to provide a logical flow to the sequence of test steps.

Dry runs are a complete end-to-end execution of the DT Test Procedures using formal test configurations and validated scenarios, simulations, and/or test tools to assess the following criteria:

a) The laboratory environment is prepared

b) The system has been properly installed and configured

c) The system has the correct versions of both software and adaptation available, and all system parameters that need to be set have been identified

d) Procedures are mature and redline text changes are fully incorporated (i.e., test procedures can be run start to finish, as documented, without major deviations or anomalies)

Dry runs are executed by the contractor and witnessed by the DT test team for each test prior to entering formal DT testing, with dry run test results presented at the DT TRR. For each witnessed dry run, a Test Status Report is prepared by the DT test lead (see Section 6.3.6). If a dry run that is executed as if it was a formal test run and in accordance with test plans and procedures completes without any significant problems, the contractor may request that the FAA waive a second execution. If the FAA concurs, the dry run execution is accepted as a formal test run. In these cases, a Pre-Test Briefing and a Post-Test Review are conducted to capture all test execution details.

6.3.2 DT TEST READINESS REVIEW

The TRR is presented by the contractor to the FAA as required by the SOW/PWS. The objectives of the TRR are to officially establish that the contractor is prepared and ready to start formal testing of the system, and not to prematurely enter into it. The TRR covers the following items:

a) Overview of testing to be performed

b) Status of contractor development and integration milestones and checkpoints

c) Status of all applicable test documentation

d) Identification of required Government and contractor resources and personnel

e) Configuration control and accreditation of test tools and test items (both hardware and software) and any other items necessary for the successful conduct of testing, including Data Reduction and Analysis (DR&A) tools and equipment

f) Prior test results, including those from any dry runs of tests

g) Summary of all PTRs, including status of relevant hardware, firmware, and software problems

h) Review of test baseline, configuration, and environment

i) System CM status

j) GFE, GFI, and GFP status (if applicable)

k) Traceability between requirements and their associated tests using the DT VRTM

l) Test schedules

m) Test entrance and exit criteria

A draft TRR briefing package must be provided to the DT Test Director at a contractually specified date prior to the planned TRR meeting date. Successful completion of the TRR establishes the readiness for testing. The DT Test Director decides whether or not DT may commence. A copy of the approved TRR briefing package must be included with the associated DT Test Report.

6.3.3 DT PRE-TEST BRIEFINGS

Prior to each test, the contractor conducts a Pre-Test Briefing to ensure readiness to begin the respective test. The Pre-Test Briefing covers the following items:

a) Test objectives and success criteria in accordance with the approved Test Plan and Test Procedures

b) Proposed procedure changes (redlines)

c) Test configuration definition (e.g., hardware, adaptation, software version levels, patches, configuration files), including any GFE

d) Test personnel assignments and Government and contractor resources

e) Test conduct walkthrough

f) Results of the CM audit

g) Test limitations

h) Review of known system anomalies that might impact testing

i) Planned deviations

j) DR&A methods

k) Results of any dependent testing that demonstrate readiness for test conduct

The DT Test Director and contractor test manager (or their designees) review and approve all planned deviations presented at the Pre-Test Briefing.

6.3.4 FORMAL DT TEST EXECUTION

The standard process items for formal test execution include:

a) The DT Test Director may delegate signature approval to the appropriate DT test team member. The signature approval grants those test team members with authority to initial changes to the formal Pre-Test Briefing and Post-Test Review packages and redlines during formal test conduct.

b) The DT test team witnesses the formal runs of all tests. Copies of procedures are provided to the FAA personnel witnessing formal test runs.

c) Proper test configuration is verified prior to starting formal test (including hardware, software, firmware, adaptation parameters, test equipment, and test tools).

d) A Test Status Report is prepared for each formal test run (see Section 6.3.6.).

e) The DT test team witnesses deviations and changes to the Test Procedures.

f) The DT test team ensures that anomalies are properly documented (at the time of occurrence) in the test log and that the test log is signed at the completion of testing.

g) The contractor provides the "as-run procedures" (i.e., with mark-ups) and test log informally after test completion.

h) The contractor performs a walkthrough review of the DR&A results of the test data with the DT test team to verify requirements.

6.3.5 DT POST-TEST REVIEWS

The contractor conducts a Post-Test Review with the FAA for each test performed to confirm test results and completion. The Post-Test Review consists of:

a) Overall test results, including a summary of all associated requirements

b) Status of test objectives and exit criteria as specified in the associated Test Plan and Test Procedures

c) Test conduct details (e.g., start date and time, stop date and time, etc.)

d) Any test configuration changes since the Pre-Test Briefing

e) All problems encountered, including where and how they are documented

f) Descriptions of all deviations and anomalies encountered

g) Test procedure changes

h) Details on any failed steps and requirements

i) Review of DR&A results and walkthrough findings

j) Regression test recommendations

k) Documentation of the outstanding test issues with action plans for closure

6.3.6 DT TEST STATUS REPORTS

The DT test lead prepares a Test Status Report for each dry run and formal test run. The Test Status Report is distributed to the DT test team and entered into the test status database (which is managed by the test team). The test status database is used to document all information pertaining to a given test execution for a particular DT test activity, including: test name, FAA and prime contractor participants, facility name where the test is conducted, software version, lab configurations, summary and specific details of the test, issues/concerns, and the next test activities.

Note: Refer to the V&V Repository for the Test Status Report template.

6.3.7 DT PROBLEM REPORTING PROCESSES

The contractor develops and maintains a database for submitting, tracking, reporting, and maintaining records on PTRs. The database will support the FAA in maintaining awareness of problems from initiation to final corrective action and archiving. The database will enable status

reporting of all test problems. The contractor uses the database for tracking problems associated with any system, equipment, software, or firmware that has been placed under formal configuration control. The FAA reviews the overall design of the database to ensure operational use and functionality required by the Government. The contractor will provide Government personnel with access to the database and provide reports at the request of the Government.

PTRs entered into the database should be prioritized by the contractor (with review and concurrence by the FAA) according to the following definitions:

> Priority 1 is assigned to a problem that prevents the accomplishment of an operational, mission-critical or mission-essential capability, or jeopardizes safety, security or other requirements designated as Critical Performance Requirements (CPRs).
>
> Priority 2 is assigned to a problem that adversely affects the accomplishment of an operational, mission-critical or mission-essential capability and no work-around solution is known.
>
> Priority 3 is assigned to a problem that adversely affects the accomplishment of an operational, mission-critical or mission-essential capability, but a work-around solution is known.
>
> Priority 4 is assigned to a problem that results in a user/operator inconvenience or annoyance, but does not affect a required operational, mission-critical or mission-essential capability.
>
> Priority 5 is assigned to any other problem/defect not described above (e.g., system documentation errors).

These definitions are also applicable to Discrepancy Reports (DRs). DRs may be generated prior to OT for all issues discovered that impact operational requirements but are not being addressed and need to be evaluated during OT (see Section 7.6.4).

The contractor problem-reporting system must be defined in the T&E activities section of the Test Plan. The contractor submits the planned corrective action for each problem and identifies the proposed regression testing or future modification(s) to the testing program required to validate the successful corrective action. If a component fails during testing, the contractor must perform failure analysis to identify the cause of the failure. Failed steps, with or without associated problems, will be explained to the satisfaction of the Government. All anomalies will be jointly analyzed by the contractor and the Government to determine a recovery plan.

The contractor is responsible for any corrective actions necessary to ensure full specification compliance. The contractor completes repairs or procedural changes prior to submission for regression testing. GFP-induced anomalies will be identified to determine Government responsibilities for corrective actions. GFP anomalies do not relieve the contractor from compliance to specification requirements.

6.3.8 DT REGRESSION TESTING

The contractor conducts regression tests when changes have been made to the hardware or software for which the Government has previously accepted test results. The contractor recommends and briefs the Government on the level of regression testing as part of the corrective action. The DT Test Director will determine the extent of regression testing required. Regression testing will not be started by the contractor until receiving Government concurrence

to proceed with the regression test. In addition, regression testing and analysis will ensure that the fix did not cause a problem elsewhere in the system.

The contractor will determine and fully document the cause of the noncompliance in the problem-reporting database for any failed test and provide a written notification to the Government. The contractor will conduct the regression testing using the Government-approved test plans and test procedures. The Government reserves the right to witness all regression testing.

6.4 DT TEST REPORT

The DT Test Report addresses test results, including test conduct, data collected, the DR&A process, and conclusions to be drawn from the test data. The FAA utilizes the results contained in the test report to verify that a contractor has furnished a product that conforms to all contract requirements for acceptance. The contractor will develop a DT Test Report that includes the following:

a) A copy of the approved TRR briefing package

b) All approved deviations and waivers generated as a result of testing

c) As-run test procedures with test logs and witness signatures

d) A test summary providing the status of each requirement tested

e) All test results, including data analysis (graphs, pictures, etc.)

f) Evaluation of system deficiencies and performance based on the testing results

g) Pre-Test Briefing and Post-Test Review packages

h) Complete identification of the test configuration, including hardware, software, firmware, adaptation parameters, test equipment, and test tools

The DT Test Report also includes separate sections for test activities and results from Security and Safety requirements verification, as defined in the contract.

The objectives of the DT Test Report are to provide essential information in support of decision-making, assessing technical and investment risks, and verifying the attainment of technical performance specifications and objectives documented in the DT Test Plan.

Upon receipt from the contractor, the DT Test Director forwards the DT Test Report to the DT test team and the TSB for review and comment. Subsequently, the DT test team and the TSB review the revised DT Test Report prior to the DT Test Director's recommendation for approval by the CO.

Refer to Appendix D, Figure D-7, for the complete DT Test Report review and approval cycle.

Note: Refer to the V&V Repository for the DT Test Report template and a DT Test Report sample.

7 T&E SUPPORT TO SOLUTION IMPLEMENTATION - OT

Following DT and Government Acceptance (GA) of the system or service, T&E support to SI continues with the Operational Test (OT) phase of the T&E program. OT encompasses T&E of a system's or service's operational requirements. The primary objective of OT is to validate that a new or modified system is operationally effective and suitable for use in the National Airspace System (NAS) and the NAS infrastructure is ready to accept the system. OT is performed by the ANG-E OT Test Director and OT test team with Air Traffic (AT), Technical Operations, and second-level maintenance personnel. Other participants may include representatives of other FAA organizations and/or external entities (e.g., airlines, cargo carriers, military, private industry) as required. OT is conducted at the FAA William J. Hughes Technical Center (WJHTC) and/or FAA field sites.

For designated programs, the data from OT is also used to support Independent Operational Assessment (IOA). The results of OT are used to support the Independent Operational Assessment Readiness Declaration (IOARD), which is prepared by the Program Office in accordance with AMS to mark the start of IOA.

This section of the handbook describes the processes necessary for OT planning, conduct, and reporting. Additionally, Appendix D identifies the major OT work products along with their associated review and approval cycles.

7.1 OT OVERVIEW

OT consists of the following two major test activities:

a) NAS integration testing

b) Operational effectiveness and suitability testing

7.1.1 NAS INTEGRATION TESTING

NAS integration test activities are conducted to baseline the new/modified system's performance, establish the NAS end-to-end performance baseline, and verify that current NAS performance has not been degraded. Additionally, these tests verify external interface connectivity from the system under test to other FAA and/or vendor-provided systems.

7.1.2 OPERATIONAL EFFECTIVENESS AND SUITABILITY TESTING

Operational effectiveness and suitability testing includes user participation and may consist of the following test activity subdivisions:

a) Reliability

b) Maintainability

c) Availability

d) Supportability

e) Degraded operations

f) Stress and NAS load testing of all interoperable subsystems

g) Human Factors (HF) evaluations

h) Safety requirements validation and testing to identify new safety hazards

i) Security

j) Site adaptation

k) Transition and switchover/fallback

l) Certification criteria

m) Training

n) OT Regression Testing

7.2 OT TEST OBJECTIVES

OT validation derives its test objectives from Critical Operational Issues (COIs), Critical Performance Requirements (CPRs), and the full set of requirements specified in the Program Requirements Document (PRD) of the system under test. COIs focus on the system's overall capability to support the operational mission. CPRs are requirements deemed essential to the successful performance of the system or service in meeting the acquisition program's mission needs. (Note: If CPRs are not delineated in the PRD, then they must be identified by the Integrated Test Team (ITT).)

A COI is decomposed into Measures of Effectiveness (MOEs) and Measures of Suitability (MOSs), both of which are analyzed to identify Measures of Performance (MOPs). The MOPs contain testable parameters which form the basis of the OT test objectives. These OT test objectives form the foundation for test procedures by consolidating them into logical and comprehensive test run components.

COIs, MOEs, MOSs, and MOPs are described in more detail in Section 5.3.3.2, Decomposition of Critical Operational Issues. CPRs are described in more detail in Section 5.3.3.3, CPR Evaluation Approach.

7.3 OT TEST TEAM TASKS AND FUNCTIONS

The OT test team conducts operational testing of a new or modified system in accordance with the tasks and functions described in the following subsections (see Figure 7-1, FAA OT Process Flow).

7.3.1 OT TEST TEAM ORGANIZATION

The OT Test Director has overall program responsibility for OT, and works with the ITT to define personnel and resource requirements for the OT program. In large programs, the OT Test Director designates select test team members as test leads. The various test lead responsibilities are selectively assigned on the basis of each member's level of experience and area of specialization. Test leads are responsible for all activities related to their respective test area. For small or non-complex programs, the OT Test Director may also serve as the test lead. Additionally, for programs that have been designated for an IOA, the Independent Safety Assessment Team will monitor OT activities.

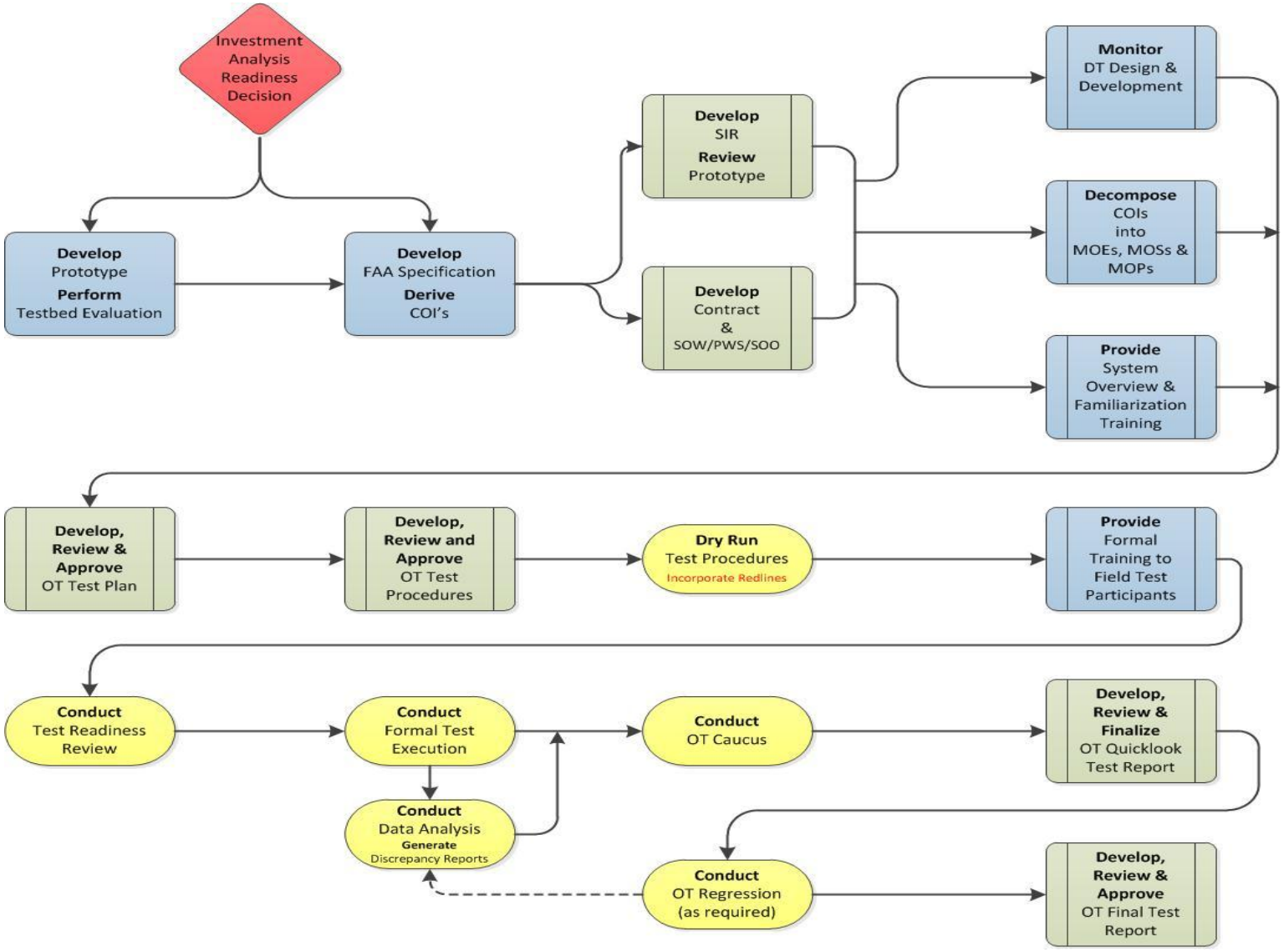

FIGURE 7-1. FAA OT PROCESS FLOW

7.3.2 OT PLANNING IN TEMP DEVELOPMENT

Planning for an OT program begins with the formation of the ITT. The OT Test Director and OT test team work in conjunction with the DT Test Director, DT test team, and other program stakeholders to develop the TEMP. This document incorporates DT and OT test approaches, which include an initial test design for determining system performance, effectiveness, and operational suitability.

The OT section of the TEMP details the following:

a) OT philosophy and approach

b) All systems and configurations to be tested

c) Any required special facilities or test capabilities, including telemetry, aircraft for flight testing, and support equipment resources

d) Roles and responsibilities for the OT Test Director, test team, field leads, and participants

e) Test entrance and exit criteria

f) Methodologies for resolving COIs

g) OT limitations and their possible impacts on validation of OT requirements (e.g., incomplete or unavailable test environment(s), operational interfaces, operational facilities, resources, training, and technical manuals)

h) Plans and methods for early, interim, and final reporting on OT issues and results

7.3.3 OT SUPPORT TO CONTRACT ADMINISTRATION

To ensure that the operational perspective is taken into account during the design, development, and testing of a new system, and to ensure that contractor support to the OT effort is made available, the OT Test Director works with the DT Test Director to develop the T&E requirements for the Screening Information Request (SIR). The SIR includes a description of work requirements (e.g., Statement of Work (SOW), Performance Work Statement (PWS) or Statement of Objectives (SOO)) for the contractor's proposal. See Section 5.5 for a detailed description of OT SIR support requirements.

7.3.4 OT TRAINING

The OT Test Director is expected to be an expert in the domain for the program in which that person leads. Additionally, T&E specific training and qualification are required to ensure that each OT Test Director understands the policies and processes related to T&E.

The OT Team receives:

a) Training on system operations and functionality, provided by the contractor as required by the contract, along with participation in the oversight of the system development by the contractor for system familiarization

b) T&E Handbook and QMS process training to ensure that T&E practitioners fully understand what is expected to successfully perform the OT Test Program

c) Training through participation in prototype testbed activities and DT activities

d) Hands-on familiarization for the system under test

7.3.5 COORDINATION WITH OT FIELD PERSONNEL

Coordination with OT field participants starts during the T&E Planning and Support phase to ensure that the OT field team is formed and their participation in the program is well-established by the time formal OT takes place. The team is composed of field Subject Matter Experts (SMEs), field supervisors, Program Office representatives, and representatives of other organizations as required.

The field team liaison is a key member who serves as the Point of Contact (POC) between the OT test team and the OT field team. The liaison assists with:

a) Defining field personnel requirements

b) Coordination with field organizations, union representatives, and site personnel

c) Travel issues such as facility security requirements for visitors

d) OT test procedure development activities

e) OT test procedure dry runs

f) Formal OT conduct coordination

g) Field test team briefings

h) Defining operational issues

i) Collection and disposition of field test team issues

7.3.6 OT TEST CAPABILITY ACCREDITATION

OT test capabilities must be accredited in accordance with Section 9.1.

7.4 OT TEST PLANNING

7.4.1 OT TEST PLAN DEVELOPMENT

The OT Test Plan describes the planning and preparation activities required prior to the conduct of OT. It includes a description of the testing to be accomplished, how test procedures will be executed, and how test results will be reported. It provides sufficient detail to guide the development of the OT Test Procedures.

The OT Test Plan addresses the following topics:

a) Test management

b) Identification and descriptions of tests to be conducted (providing enough detail so that test procedures can be written based on these test descriptions)

c) Test tools

d) Test environments and facilities

e) Accreditation plans for test capabilities

f) Schedule

g) Configuration Management (CM) in accordance with the CM Plan

h) Safety (system and personnel safety)

i) Security

j) Requirements tracking through an OT Verification Requirements Traceability Matrix (VRTM)

k) Testing of interfaces to the NAS

l) Discrepancy/Program Trouble Reporting, categorization, and resolution

m) Test limitations

n) Test reporting strategy including CPR and COI status (Interim Assessment Reports, Quicklook Test Reports, and Final Test Reports)

The OT Test Director must ensure that the OT Test Plan has been peer-reviewed (see Section 1.9) prior to submission to management for endorsement/approval. The OT Test Plan requires endorsement by the TSB and the Technical Strategies and Integration (TSI) Senior Manager, and the approval of the respective T&E Senior Manager and the Program Manager. Minor changes to the OT Test Plan that do not impact test strategy or scope (e.g., minor schedule changes, editorial corrections, etc.) will be considered working drafts only and do not require these approval signatures but are still subject to Document Management and Control.

Refer to Appendix D, Figure D-8, for the complete OT Test Plan review and approval cycle.

Note: Refer to the V&V Repository for the OT Test Plan template and OT Test Plan samples.

7.4.2 OT VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (VRTM)

The purpose of the OT VRTM is to address all COIs and program requirements to be verified and validated as part of the OT test program. The OT VRTM accomplishes this by mapping the COIs/MOEs/MOSs/MOPs and applicable program requirements from the PRD to the respective OT test activities and test cases in which the MOPs and requirements will be verified and validated.

The TEMP VRTM, which maps the COIs/MOEs/MOSs/MOPs and program requirements to the respective test phase(s) and test activities, provides the basis for developing the OT VRTM (see Section 5.3.3.5). During OT Test Plan development, the VRTM is further refined to include COI/MOE/MOS/MOP and program requirement mapping to the individual OT test cases.

Note: Refer to the V&V Repository for the VRTM template.

7.4.3 OT ENTRANCE CRITERIA

The OT phase begins after GA of the contractor-developed system. In addition to ensuring that the DT exit criteria have been satisfied, the OT Test Director plays a key role in ensuring that OT entrance criteria are fully met before formal OT testing begins. This is accomplished through participation in the ITT, early contractual planning, program meetings, and DT activities. The minimum entrance criteria for formal OT include the following:

a) DT Exit criteria, as defined in the approved CMTP and the DT Plan(s), have been satisfied

b) All Priority 1, Priority 2, and critical DT Program Trouble Reports (PTRs) that impact OT have been fixed and incorporated into the OT test baseline

c) The OT Test Plan has been reviewed and approved

d) The OT Test procedures have been reviewed and dry runs have been completed

e) All equipment and software required by the OT Test Plan and Procedures have been installed and are available

f) All planned OT test capability accreditation has been completed

g) The OT TRR has been conducted (see Section 7.6.2). The Program Manager or representative approves the start of formal OT with signature on the TRR package

h) If required, test capability accreditation has been conducted and approved

The formal OT test events may start once the above criteria have been satisfied. All deviations from test standards in the T&E Handbook and the entrance criteria in the OT Test Plan must be reported to the T&E First-Line Supervisor and documented in the TRR. Any major deviations from test standards must be rationalized, documented, and approved in a waiver that is provided at the TRR.

Note: Refer to the V&V Repository for the Request for Waiver form.

7.4.4 OT EXIT CRITERIA

OT exit criteria ensure that the OT objectives have been met and that the system has been adequately verified and validated for operational effectiveness and suitability.

Following formal OT conduct, the OT Test Director will facilitate a review of the OT test results, including a discussion of the OT exit criteria, with the ITT in order to determine whether OT can be exited. Action plans must be created for any exit criteria items that have not been met. The achievement of the OT Exit Criteria will initiate the finalization of the OT Final Test Report, which is required for ISD entrance criteria. The minimum exit criteria for OT include the following:

a) Discrepancy Reports (DRs) and PTRs that impact the ability of a system to be used operationally have been fixed, verified, and regression-tested. These must be identified and approved through the OT Caucus (see Section 7.6.5).

b) In accordance with the OT Test Plan and Test Procedures, the defined test objectives and test requirements for each test must have been addressed, met, and any support analyses completed and documented. These include:

   1) All planned OT test procedures have been satisfactorily executed

   2) All MOP data has been collected and assessed

   3) All COIs and CPRs are fully assessed and statused

7.5 OT TEST PROCEDURES

The OT test procedure development process consists of translating the test descriptions and evaluation approaches contained in the OT Test Plan. The approach to OT data collection includes both objective measurements of system parameters and subjective user-evaluation questionnaires.

The OT Test Director oversees the development of the OT test procedures by the OT test team. After the OT test procedures have been developed (including checkout and debugging), the OT Test Director must ensure that the draft OT Test Procedures document has been peer-reviewed (see Section 1.9). The draft OT Test Procedures should be made available to the Test Standards Board (TSB) for optional review. After receiving and incorporating any comments from the TSB, the OT Test Director must approve the document for use in test conduct.

Refer to Appendix D, Figure D-9, for the complete OT Test Procedures review and approval cycle.

Prior to formal OT, a dry run of the procedures must be performed. All OT test procedures must address COIs, MOEs, MOSs, and MOPs through their respective test requirements. It is recommended that field site personnel participate in the dry run process to ensure that the test environment, procedures, and system are ready for formal testing.

7.5.1 OT TEST PROCEDURE DEVELOPMENT

OT test procedure development is comprised of the following three stages:

a) Procedure Development: The formulation of procedures that take into account operational conditions, measures, user stimuli, and scenarios that address the OT requirements identified in the OT VRTM. This step must also associate and incorporate the MOEs, MOSs, and MOPs. It may also include system checkout activities needed to support procedure development. Evaluating specific functionality requires that the procedures contain step-by-step detailed instructions to ensure test objectives are met and the intended data is collected. To evaluate operational capabilities, high-level nonspecific test procedures are used to allow the participant to realistically use the system and respond to events.

b) Procedure Debugging: The running of the test procedures against the system under test to ensure that the test steps are correct and complete. During this stage, the procedures are refined and updated to provide a logical flow to the sequence of test steps.

c) Dry Runs: A complete end-to-end execution of the OT Test Procedures using formal test configurations to assess the following criteria:

   1) The laboratory environment is prepared

   2) The system has been properly installed and configured

   3) The system has the correct versions of both software and adaptation available, and all system parameters that need to be set have been identified

   4) Any new or modified test scenarios, simulations, or tests tools are valid

5) Procedures are mature and redline text changes are fully incorporated (i.e., test procedures can be run start to finish, as documented, without major deviations or anomalies)

Note: Refer to the V&V Repository for the OT Test Procedures template and an OT Test Procedures sample.

7.5.2 OT TEST PROCEDURE QUESTIONNAIRES

Objective measures should always be the primary source of system information. Questionnaires are used to augment objective performance measures or to provide substantive information when objective data is unavailable or difficult to collect. Care should be taken if there is insufficient objective data and emphasis falls on the questionnaire responses. The OT user-evaluation questionnaires must:

a) Be effectively written to avoid the solicitation of biased replies. It is important that the evaluation questions do not allow individual preferences of the test subject to be reflected in the reply.

b) Be clear, concise, and directly relevant to the MOEs or MOPs to be assessed.

c) Support the assessment of the capabilities of the system to support operational tasks.

d) Be in the form of numerical rating scales, or "yes" or "no" answers to questions. Test subjects may provide subjective elaborations, or explanations on specific questions, to support their responses.

Appropriate union approval from the National Air Traffic Controllers Association (NATCA), National Association of Air Traffic Specialists (NAATS), or Professional Airways System Specialists (PASS) is required before a questionnaire may be used. Approval may involve significant lead time.

Note: Refer to the V&V Repository for the OT Questionnaire guidance and OT Questionnaire samples.

7.5.3 OT TEST PROCEDURE TRACKING

The OT test team tracks and reports the status of OT test procedure development through an OT Test Procedures Status Matrix. This status matrix will, at a minimum, indicate the progress toward completion of the documentation, debugging, and dry runs required for each planned OT test procedure. Additionally, a Test Status Report is generated at the conclusion of each test activity (checkout, debug, or dry run) and provided to the ITT. Any anomalies or discrepancies are reported and analyzed for their impact on performing formal OT.

Note: Refer to the V&V Repository for the OT Test Procedures Status Matrix and Test Status Report templates.

7.6 OT TEST CONDUCT

The OT test team, with the support of the field participants, conducts OT in accordance with the approved OT Test Plan and Test Procedures. OT does not begin until the OT entrance criteria

(as documented in the TEMP) are met. The ITT convenes to determine compliance with the OT entrance criteria. An OT TRR is then conducted to ensure that all elements are in place prior to commencing with formal OT conduct.

7.6.1 LOGISTICS FOR FORMAL TEST CONDUCT

The following list describes the logistical activities that need to be coordinated prior to the OT TRR:

a) Approval of all required test-related NAS Change Proposals (NCPs).

b) Coordination of site access and security clearances.

c) Coordination of training for the test team and field participants.

d) Installation of the system under test is complete and complies with the documented baseline.

e) Completion of the configuration baseline audit to identify all software, firmware, and hardware versions in the system under test.

f) Ensuring that the OT Test Director accomplishes the following:

   1) Defines roles and responsibilities of all team members.

   2) Coordinates all tasks required for test conduct. This includes laboratory coordination and scheduling, data collection activities, Pre-Test Briefings and Post-Test Reviews, observers, simulation support, and interface support.

   3) Maintains all test schedules.

   4) Establishes procedural checklists.

   5) Conducts preliminary OT reviews of all scheduled activities with team members and the Facility Manager.

   6) Ensures that the Facility Manager is informed on all planned test activities.

   7) Ensures that the Facility Manager coordinates planned test activities with adjacent facilities.

   8) Ensures that the Facility Manager coordinates and schedules required live testing procedures, interfaces, and events.

7.6.2 OT TEST READINESS REVIEW

The OT TRR is conducted by the OT test team prior to the start of the formal OT activity. This review verifies and approves the readiness to start formal OT and ensures participants understand the outstanding issues. The TRR also communicates risks and limitations for formal OT. The TRR includes:

a) Review of OT entrance criteria as documented in the OT Test Plan

b) Discussion and documentation of impacts if entry criteria are not fully met

c) OT approach, test objectives, and test structure

d) Test schedule

e) Hardware and software versions and configurations

f) CM process and test data management

g) Test team roles and responsibilities

h) Ensuring that all OT Test Plans and Test Procedures are approved by the appropriate authorities

i) All OT procedure checkouts and dry runs have been conducted successfully

j) DR process

k) Reviewing known problems and workarounds (identify test impacts and criticality of operational issues)

l) Test limitations, risks and deviations from the approved OT Test Plan are understood and documented

m) Required test personnel are system-trained and available to support testing

n) Required technical and user documentation are current and available during testing

o) System adaptations are documented, available, and executable

p) Required Test Capability Accreditation Reports are complete

q) Data Reduction and Analysis (DR&A) tools, test tools, simulators, and emulators are functional, configured, and certified

r) Review of OT exit criteria

s) Program Manager or representative approves/disapproves the start of formal OT. A signature on the TRR package is required for approval.

Before the start of the Test Readiness Review (TRR), a draft TRR package is provided to the TSB at least five days prior to the event for review. The TSB may participate in the TRR event.

7.6.3 FORMAL OT CONDUCT

Formal OT conduct consists of Pre-Test Briefings, test executions, Post-Test Reviews, and status reporting.

7.6.3.1 OT PRE-TEST BRIEFINGS

The OT Pre-Test Briefing is presented by the OT test lead and consists of the approach for each test to be conducted. It includes a review of:

a) Test objectives and success criteria

b) Test configurations (hardware, adaptation, software level, patches, test tool certification, and configuration files)

c) Test personnel assignments

d) Test conduct walkthrough

e) Proposed procedural changes or planned deviations

f) Test limitations

g) The status of all known problems and anomalies that may impact the test or its results

h) Methods of data collection

7.6.3.2 OT EXECUTION

OT test case executions are the culmination of OT planning efforts resulting in the complete and official running of the OT Test Procedures. These test cases are the primary data source for OT requirements validation.

During formal OT, the test lead maintains a log of all system state changes and records information concerning any laboratory or system issue that results in a deviation of, or impact on, the test. Such incidents include, but are not necessarily limited to, system reboots and hard failures. Test observer logs are used to capture issues that impact operational effectiveness or suitability. If questionnaires are being used to capture qualitative data, they must be completed and collected immediately following the test execution. The test lead also maintains a list of DRs that identify all issues encountered during testing (see Section 7.6.4).

7.6.3.3 OT POST-TEST REVIEWS AND TEST STATUS REPORTING

An OT Post-Test Review is held at the conclusion of each test or at the discretion of the OT Test Director. The main focus is to get field personnel to clarify any issues that are not fully documented and to hold initial discussions on any impacts on operational effectiveness or suitability. The development engineers responsible for troubleshooting issues should attend to ensure that they fully understand the issues. The test lead generates briefing minutes and assigns action items.

The OT Post-Test Review includes:

a) Review of test results, including a summary of verified requirements

b) The status of test objectives and success criteria

c) Review of all issues in the respective logs of the test lead and observers

d) Review of all problems for accuracy, completeness, and recommended dispositions

e) Review of all blue-line deviations (changes to test procedures made during formal test conduct) from the test procedures

f) Recommendations for retesting or regression testing

A Test Status Report is generated following the completion of each test. This report summarizes the results of testing, highlights significant findings, and provides an assessment of whether the objectives were met. It also records any DRs and comments made against the system documentation. The contents of the OT Post-Test Reviews and Test Status Reports are used to support development of the OT Quicklook Test Report and Final Test Report.

Note: Refer to the V&V Repository for the Test Status Report template.

7.6.4 OT DISCREPANCY REPORTING

DRs are generated for all issues discovered during OT. DRs are also generated prior to OT for all issues discovered that impact operational requirements but are not being addressed and need

to be evaluated during OT. A DR must contain enough detail to document the issue and facilitate corrective action. Such details include, but are not necessarily limited to, the following:

a) Unique DR identifier

b) Project or system identification

c) Requirement(s) impacted

d) Description of the issue

e) Priority of the problem (see Section 6.3.7)

f) Impact of the problem

g) Name or number of the test procedure

h) Test step at which the event occurred

i) Test configuration and system states

j) Supporting records and data (e.g., logs, screen saves, system records, system reports, test tool data, plots, etc.)

k) Associated PTR number (if applicable)

l) Associated resolution upon closure

Note: Refer to the V&V Repository for the Discrepancy Report form.

The OT Test Director and test team must conduct DR reviews on a regular basis to ensure accurate descriptions, determine validity, disposition priorities, and assess proposed resolutions. To facilitate efficient tracking of issues discovered during OT, the OT Test Director maintains a DR database. DRs are tracked until dispositions are documented for each and are closed out when the OT Test Director and the relevant stakeholders are satisfied that the issue has been resolved or mitigated. All DRs that require corrective action by the contractor are raised to PTR status. DRs that have been raised to PTRs are not closed out as DRs until corrective action has been implemented by the contractor and verified by the FAA.

7.6.5 OT CAUCUS

The OT Caucus, chaired by the OT Test Director, is conducted to analyze the operational impact of all problems encountered during testing and to gain concurrence on their criticality. Participants include representatives from the OT test team, field team(s), and the sponsoring organization.

The OT Caucus is held after the completion of formal testing. In preparation for the caucus, all OT DRs and PTRs are entered into an OT Problem Traceability Matrix. At the caucus, the matrix is reviewed to assess the impact of DRs and PTRs on COIs, MOEs, MOSs, MOPs, and CPRs, and to determine their operational criticality. All DRs that require corrective action by the contractor are raised to PTR status. PTRs are assigned initial priorities to assist with resolution plans. At the caucus, each COI must be answered based on the criticality of the problem(s) impacting it.

An OT Caucus Summary Report is produced to document the status of each COI, MOE, MOS, MOP, and CPR for the system under test. This report supports resolution of critical PTRs prior

to operational deployment. This report and the PTR resolution plans provide the framework for any regression testing that may be necessary to resolve outstanding critical PTRs.

Note: Refer to the V&V Repository for the OT Problem Traceability Matrix and OT Caucus Summary Report templates.

7.6.6 OT REGRESSION TESTING

OT regression testing is testing conducted to verify the integrity of solutions to DRs/PTRs. Additionally, regression testing is performed to ensure that these solutions have not introduced any new problems or issues, and to support validation of the system's readiness for operational use. Regression testing may require the participation of the OT field team(s). Regression testing must:

a) Ensure the functionality of corrective actions

b) Demonstrate that the corrective actions do not impact other system functionality

c) Re-run OT test procedures that were impacted by the problem

d) Re-run OT test procedures that may be impacted by the fix

e) Follow the same processes required for formal OT

f) Be documented in an OT Quicklook Test Report or the OT Final Test Report

7.7 OT TEST REPORTING

OT test reporting is comprised of the following reports:

a) Interim Assessment Report(s)

b) Quicklook Test Report(s)

c) Final Test Report

7.7.1 OT INTERIM ASSESSMENT REPORT

The OT IAR is an optional reporting mechanism that will provide management with an assessment of the current state and maturity of the system by identifying system capabilities and limitations as tested for that reporting period. OT IARs are developed following specific milestones, whether issues exist or not, as defined in the TEMP. The OT IAR must be provided to the TSB and ITT for their review and comment.

The OT IAR will provide sufficient data to support resolution plans and program decisions. Additionally, the OT IAR will assist in the planning for future test activities and support planning for system implementation and deployment. Specifically, the OT IAR:

a) Provides the status of critical performance criteria defined in the TEMP

b) Analyzes issues based on their impact on COIs and CPRs

c) Provides early operational reporting for:

   1) DT

   2) Pre-formal OT conduct

3) Formal OT conduct

d) Highlights critical system issues which may impact the following operational milestones:

1) Initial Operational Capability (IOC)

2) ISD

3) Operational Readiness Demonstration (ORD)

e) Provides a programmatic decision-making assessment for test planning, site deployment, and site acceptance testing

f) Supports operations and maintenance planning

g) Provides input to the OT Quicklook Test Report and OT Final Test Report

The OT Test Director must provide the draft OT IAR to the TSB and the ITT for review and comment prior to electronically distributing the final document to the respective T&E Senior Manager, the Program Manager, the TSI Senior Manager, and the TSB.

Refer to Appendix D, Figure D-10, for the complete OT IAR review and approval cycle.

Note: Refer to the V&V Repository for the OT IAR template.

7.7.2 OT QUICKLOOK TEST REPORT

The OT Quicklook Test Report is developed following the completion of formal OT to provide a preliminary assessment of operational effectiveness and suitability. This report is provided in advance of the more detailed Final Test Report which requires more analysis and time to complete. The report contains preliminary results, and therefore is not intended to support programmatic or operational milestone decisions.

The OT Quicklook Test Report documents the preliminary results of all formal testing and the resolution plans of any issues discussed at the OT Caucus. It expands upon the content provided through the OT Caucus Summary Report. General descriptions of the system's performance and functional and operational limitations are included in the Quicklook Test Report. If the resolution of program issues delays delivery of the OT Final Test Report, an OT Quicklook Test Report may be required after each major OT regression test.

The OT Quicklook Test Report includes:

a) An executive summary

b) Background information on the testing

c) A summary of test activities, including test article configuration

d) A synopsis of preliminary test results

e) Preliminary conclusions

f) OT Issues Matrix as an appendix

It is critical that the draft OT Quicklook Test Report be provided to the ITT and the TSB for their review and comment in time to support problem resolution and IOC/ISD preparation activities.

It is recommended that the approved OT Quicklook Test Report be delivered within 15 calendar days from the completion of the test. The approved OT Quicklook Test Report must be electronically distributed to the respective T&E Senior Manager, the Program Manager, the TSI Senior Manager, the Technical Center Director, and the TSB.

Refer to Appendix D, Figure D-11, for the complete OT Quicklook Test Report review and approval cycle.

Note: Refer to the V&V Repository for the OT Quicklook Test Report template and an OT Quicklook Test Report sample.

7.7.3 OT FINAL TEST REPORT

The OT Final Test Report presents specific findings related to the operational effectiveness and suitability of the system. The report:

a) Contains an executive summary which summarizes the test results

b) Addresses the resolution of all COIs

c) Assesses the degree of operational readiness of the system

d) Characterizes the operational capabilities and limitations of the system based on system performance against the CPRs

e) Documents the methods used in, and results of, the detailed analyses of test data

f) Identifies and assesses PTRs and issues that impact critical capabilities and benefits

g) Updates the status of problems highlighted in the OT Quicklook Test Report

h) Provides status of exit criteria as defined in the OT Test Plan

i) Includes test descriptions, results, conclusions, and recommendations

j) Identifies technical or operational risk areas

k) Includes all approved deviations and waivers generated as a result of testing

Conclusions regarding operational effectiveness and suitability are based on the combined results of all operational tests. System capabilities are determined on the basis of operational effectiveness and suitability performance in accordance with critical parameters and key requirements. In addition, the report addresses the risks or system limitations associated with shortfalls in meeting mission needs, operational requirements, and safety requirements. Identification and assessment of any new safety hazards should also be provided.

For large or high-risk test programs, the OT Test Director must conduct an OT Final Test Report Out-Brief to the ITT prior to delivering a draft Final Test Report for review. Additionally, the OT Test Director must ensure that the report has been peer-reviewed (see Section 1.9) prior to submission to management for review/endorsement/approval. The OT Final Test Report requires the endorsement of the T&E First Line Supervisor, the respective T&E Senior Manager and the TSI Senior Manager, and requires the approval of the Technical Center Director. The Technical Center Director will approve the final version of the report based on the TSB's recommendation, endorsement from the respective T&E Senior Manager and the TSI Senior Manager, and an OT Final Test Report Out-Brief by the OT Test Director (as required).

It is recommended that the approved OT Final Test Report be delivered within 60 calendar days from the completion of the test. The approved OT Final Test Report is delivered to the TSB, the Program Manager, and the Assistant Administrator for NextGen, ANG-1. The AMS requires the OT Final Test Report as part of the entrance criteria to the ISD. The Technical Center Director will provide an OT Final Test Report Out-Brief, as required, to the Assistant Administrator for NextGen, ANG -1, prior to the ISD milestone.

Refer to Appendix D, Figure D-12, for the complete OT Final Test Report review and approval cycle.

Note: Refer to the V&V Repository for the OT Final Test Report and OT Final Test Report Out-Brief templates and samples.

7.8 TRANSITION TO IN-SERVICE MANAGEMENT

Test support is often required during the transitional period from OT to In-Service Management (ISM) to correct PTRs and other performance issues. This test support is handled through service-level agreements between the DT/OT test teams and the ISM organization.

7.9 FIELD FAMILIARIZATION SUPPORT

This section only addresses processes to be followed by the T&E organization in support of Field Familiarization (FF). Site FF is the responsibility of the facility personnel at each operational site and is the final activity to achieve facility IOC. If requested by the Program Office, the test organization provides support services for FF, including the development of plans, procedures, and briefing materials. The guidance for FF conduct and planning is contained in the AMS T&E guidance document. FF is a formal T&E activity. However, its main focus is to familiarize field users, rather than providing for formal verification or validation of the system.

7.9.1 FIELD FAMILIARIZATION SUPPORT PLANNING

FF support usually consists of running test procedures that go beyond the usual site system verification and baseline testing. The general approach is to conduct activities that will allow the facility to gain confidence in the system and attain a higher level of hands-on familiarization. The level and type of FF support is determined through coordination with the Program Office, AT site representatives, and Technical Operations site representatives to identify specific areas that require T&E capabilities. Once the test organization's role is determined, an FF Support Plan is developed that details the activities. The FF Support Plan must be provided to the TSB for their review and comment prior to final delivery. FF support consists of the following activities:

a) Conduct initial planning meetings with operational and in-service management organizations to gain insight into operational concerns

b) Meet with field sites to gain the desired type of faults for system familiarization

c) Perform an assessment of familiarization needs for the site and define roles for the FF support team

d) Develop a support schedule and status tracking matrix

e) Develop a resource allocation matrix

f) Assess engineering resources required for test case development and support

g) Define FF support team training requirements

h) Define FF test tools as required

i) Develop and document test case procedures

j) Dry run test cases

k) Develop schedules to track all FF-related activities

l) Distribute the FF Support Plan to the Program Office and the site(s)

Refer to Appendix D, Figure D-13, for the complete Field Familiarization Support Plan review and approval cycle.

Note: Refer to the V&V Repository for the FF Support Plan template.

7.9.2 FIELD FAMILIARIZATION SUPPORT PREPARATION

Test procedures are developed and a dry run is conducted based on the process specified in the FF Support Plan. These procedures are packaged and delivered to each Site Test Director so that they may select specific test procedures for execution.

FF support preparation is performed in the following sequence:

a) Schedule resources and tools for test case development and dry runs

b) Conduct test case dry runs on new system releases

c) Conduct site preparation meetings/briefings 30 days prior to the start of site FF

d) Participate in training activities on system overview and architecture, Computer Based Instruction, Test Training, Operational Evaluations, etc.

e) Develop and maintain FF database as central repository for FF-related documents and data storage

Note: Refer to the V&V Repository for FF Test Procedures and FF Test Case Format samples.

7.9.3 FIELD FAMILIARIZATION SUPPORT CONDUCT

The following standard processes must be considered for the conduct of FF support activities:

a) Ensure required test equipment, tools, and documentation are delivered to the site

b) Conduct a site kick-off meeting at the start of FF site activities

c) Conduct Pre-Test Briefings prior to each individual test

d) Conduct FF testing

e) Provide support to updating site-specific procedures, handbooks, and guidance documents (as required)

f) Conduct Post-Test Reviews at the completion of each individual test

g) Conduct a wrap-up meeting at the completion of FF site activities

h) Perform regression testing on issues identified by the site (as required)

i) Assist in PTR verification and analysis (as required)

j) Generate Test Status Reports and submit them daily to the Program Manager, Test Directors, and Site Test Director

7.9.4 FIELD FAMILIARIZATION REPORTING

The site FF support team tracks all site issues surfaced during the test activities and maintains these issues in a database. A final report for each site is generated to document the activities and summarize any issues. Reports and database information are distributed to the Program Office, TSB, and site representatives.

Note: Refer to the V&V Repository for FF Report and FF Status Tracking Matrix samples.

8 T&E SUPPORT TO IN-SERVICE MANAGEMENT

T&E support to ISM consists of various T&E activities performed by the ANG-E test teams in support of program maintenance and upgrade activities under the responsibility of the second-level maintenance organizations. These ANG-E T&E activities can be categorized according to the following types of ISM program activities:

a) Major program upgrade support

b) Minor program upgrade support

c) Program maintenance support

The following sections define each of these ISM program activities and describe the T&E support provided by the ANG-E test team if tasked by the Program Office or the second-level maintenance organization to provide T&E services. Additionally, it should be noted that the specific level of ANG-E T&E service support may differ from program to program and tailoring may be required.

8.1 MAJOR PROGRAM UPGRADE SUPPORT

Major program upgrades to operational systems or services are defined as those upgrades that require new or modified program requirements, a new or modified vendor contract, and a corresponding DT and OT test program to verify and validate the upgrade prior to its implementation. For these types of upgrades, the ANG-E test team will be responsible for the DT oversight and the OT planning, conduct, and reporting. As such, the applicable T&E processes, methods, and standards defined in Sections 4 through 7 and 9 of this handbook will be followed, to include the use of the Test Planning, DT and OT Process Conformance Checklists contained in Appendices A through C.

Note: Refer to the V&V Repository for the ISM TEMP, OT Test Plan and OT Final Test Report templates.

8.2 MINOR PROGRAM UPGRADE SUPPORT

Minor program upgrades to operational systems or services are defined as those upgrades resulting from Program Trouble Report (PTR) fixes or National Change Proposals (NCPs)/case files for which there is no need for a new or modified vendor contract. In these instances, the second-level maintenance organization or the vendor will implement and test the upgrade, while the ANG-E test team will only be responsible for OT planning, conduct, and reporting. As such, in the same manner as the T&E support provided to major program upgrades as defined in Section 8.1, the applicable T&E processes, methods, and standards defined in Sections 7 and 9 of this handbook will be followed.

8.3 PROGRAM MAINTENANCE SUPPORT

In addition to the more formalized T&E support for major and minor program upgrades, the ANG-E test team may be requested to provide T&E support, as Special Support Activities, for program maintenance activities being performed by the second-level maintenance organization. For these activities, the ANG-E test team will provide T&E services in a supporting role to the second-level maintenance organization. As such, the T&E processes, methods, and standards

established by the second-level maintenance organization will be followed in lieu of those prescribed by this handbook. However, for all T&E activities performed in support of ISM program maintenance, it is recommended that the ANG-E test team applies, where possible, the fundamental practices for quality T&E as defined in Section 1.5.

Note: Refer to the V&V Repository for the Special Support Activities PDD.

9 TEST PREPARATION AND DEPLOYMENT DECISION SUPPORT

This section contains test preparation and deployment decision support processes that cross AMS lifecycle phases.

9.1 TEST CAPABILITY ACCREDITATION

Accreditation is the official determination that a model or simulation (or other test capability) is acceptable for a specific purpose. Accreditation is required for every test capability that is being used to verify and validate requirements. DT and OT Test Directors are responsible for identifying all DT and OT accreditation requirements, including proposed accreditation methods, in the TEMP. These proposed accreditation requirements and methods will be approved in conjunction with the overall TEMP approval process (see Section 5.3).

When test capability accreditation is required, accreditation plans must be detailed in an associated program test plan or a standalone Accreditation Plan. Results from accreditation testing must be documented in an Accreditation Report prior to the start of system or service testing.

Figure 9-1, Test Capability Accreditation Process, depicts the logical flow of the accreditation process. The following sections provide additional information on the process.

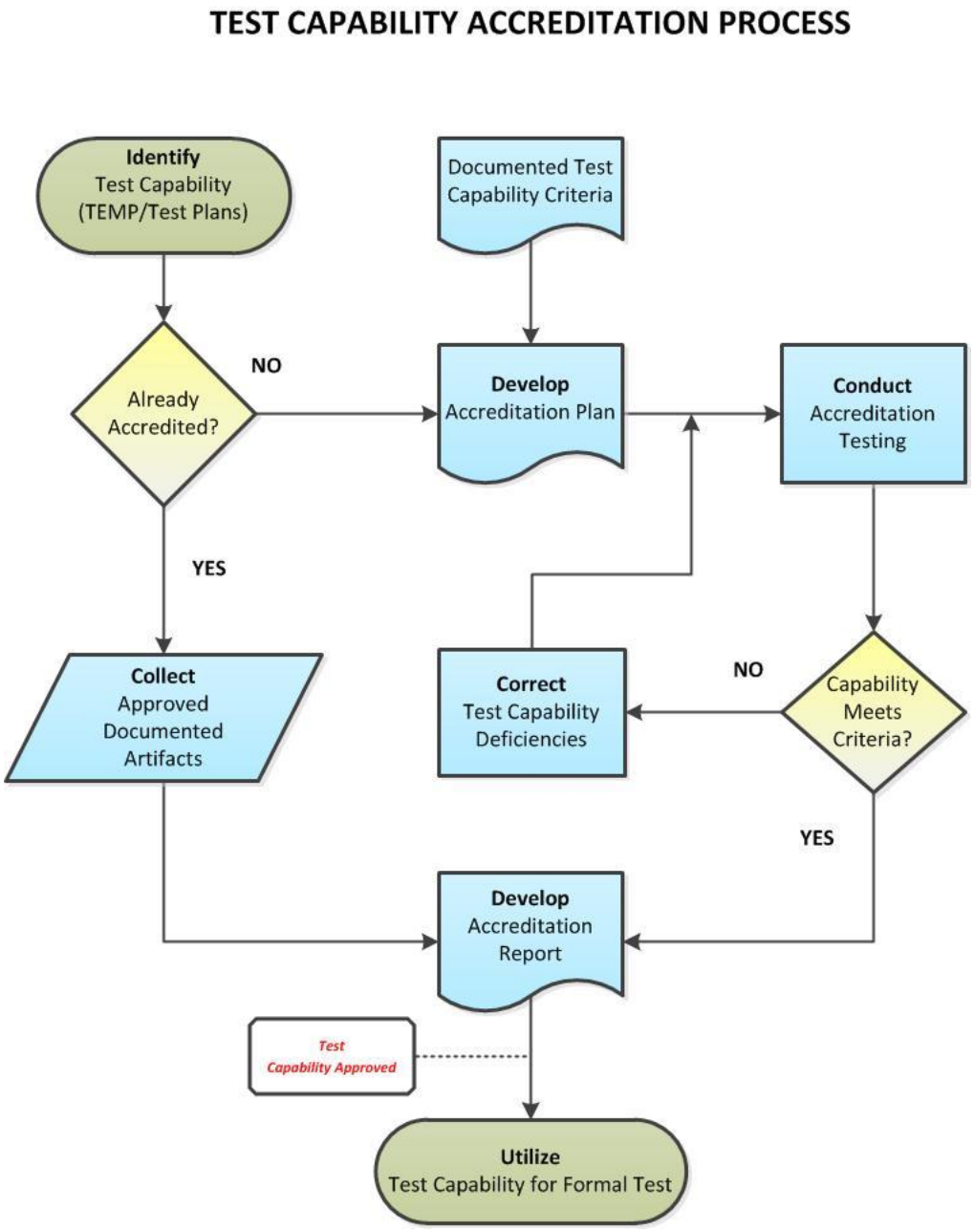

FIGURE 9-1. TEST CAPABILITY ACCREDITATION PROCESS

9.1.1 ACCREDITATION DEFINITIONS

The following terms and definitions applicable to the accreditation process are presented for the convenience of the reader:

a) Accreditation: The formal certification that a test capability is acceptable for a specific application.

b) Test Capability: Test capabilities are assets that are used in conjunction with the system/service under test or a representation of the system/service under test to generate data to address test measures. Test capabilities include testbeds, simulated environments (including files and interfaces), instrumentation and test tools (including data collection and analysis), and modeling capabilities.

c) Accreditation Verification: The formal process of determining that a test capability accurately represents the developer's conceptual description and specifications.

d) Accreditation Validation: The formal process of determining the degree to which a test capability provides an accurate and complete representation of the test capability's intended purpose (e.g., real world system loading, capacity loading, emulation of operational environments, etc.).

9.1.2 ACCREDITATION TESTING

Accreditation tests must ensure that the test capability achieves its intended purpose in supporting a T&E activity. The level of accreditation verification and validation to be performed will be driven by the required test capability performance, functionality, and fidelity necessary to support fulfillment of the objectives of a test activity or an individual test case. Examples of the test capabilities typically accredited and types of accreditation are as follows:

a) Testbeds – A testbed is a stand-alone or distributed environment created for testing purposes. It may consist of a combination of specialized hardware, software, real or simulated environmental conditions. Verification of the testbed includes ensuring that interfaces and components of the testbed function as designed and are free of defects. Validation of the testbed involves ensuring that the environment and associated stimulus provide sufficient representation of the conditions required for the test objectives.

b) Simulated environments include:

   1) Simulation Files (Scenarios/Scripts) – Simulation files or software scenarios are used to automate procedures, system load, specific complex situations, etc. Verification of simulations ensures that the simulation performs as scripted and is reliable, repeatable, and free of defects. Simulations are validated to ensure that they are realistic, comprehensive for the operational environment being simulated, and sufficient for the intended use.

   2) Simulated Interfaces – One or more interfaces are typically simulated when live data or other system interfaces are not available or practical. Verification of the simulated interface includes ensuring that it conforms to the Interface Control Document (or other interface requirements). Validation of the interface should

ensure that all the appropriate messages, data, timing, and content are sufficiently emulated by the simulated interface.

c) Instrumentation and Test Tools – Instrumentation and test tools are equipment items that include data collection and analysis tools, drivers, oscilloscopes, meters, analyzers, and probes. Instrumentation and test tools may be COTS or developmental items. Verification of the instrumentation and test tools ensures that they are performing as designed. Validation of the instrumentation and test tools ensure that they are meeting the needs for the test. Calibration may be performed to accomplish the accreditation. COTS items may use the vendor artifacts and documentation for verification and validation.

d) Modeling – Modeling is a physical, mathematical, or otherwise logical representation of a system, entity, or process. Typically, modeling is used to test and evaluate future real-world capabilities without actually implementing them. Verification of a model ensures that the model is fully functional, reliable, and accurately processing/reporting data. Validation of a model focuses on ensuring that the model encompasses all relevant variables, is representative of intended environments, and sufficiently emulates the real-world capabilities that are identified in the test case.

9.1.3 ACCREDITATION PROCESS

Test capabilities that require accreditation are identified during test design and are documented in the TEMP and test plans. Accreditation Plans are developed in parallel with the test plans. This provides the opportunity to explore alternative test approaches or modifications to the overall test process. Additionally, Accreditation Plans may be either standalone documents referenced in the test plans, or they may be included as part of the test plans. The prime contractor (for DT activities) or the OT Test Director (for OT activities) is responsible for the development of the respective Accreditation Plan(s). For DT, the DT test team conducts an early informal review of the plan(s) to ensure that they are in agreement with the contractor's accreditation strategy and to provide any other initial comments. Subsequently, the DT test team and the Test Standards Board (TSB) review the revised plan(s) for technical sufficiency prior to the DT Test Director's recommendation of approval by the Contracting Officer (CO). For OT, the TSB reviews and the TSI Senior Manager endorses the Accreditation Plan(s) prior to final approval by the respective T&E Senior Manager.

The FAA will witness all test capability accreditation activities conducted by the prime contractor for DT, and will conduct the test capability accreditation activities for OT. The accreditation analysis and results from these activities should be completed and approved no later than 30 days before the test activity, or commencement of the simulation effort, requiring the use of the test capability(ies). If this is not possible, the prime contractor (for DT) or OT Test Director (for OT) has the prerogative of proposing an alternative completion date. The proposal should contain pertinent rationales and call out any associated risks.

Results of the accreditation process are described in the Accreditation Report. This report provides information on the risks associated with using the test capability, and recommendations on whether to proceed. For DT, the prime contractor prepares the Accreditation Report and the DT test team conducts an early informal review of the report to ensure that they are in agreement with the contractor's accreditation results and to provide any other initial comments. Subsequently, the DT test team and the TSB review the revised report prior to the DT Test

Director's approval recommendation to the CO and COR. For OT, the OT Test Director prepares the Accreditation Report, the TSB reviews the report prior to final approval by the respective First Line Supervisor.

Configuration Management (CM) of test capabilities and archiving of all Accreditation Plans and Reports is the responsibility of the prime contractor (for DT) or the OT Test Director (for OT).

Refer to Appendix D, Figure D-14, for the complete DT Accreditation Plan and Accreditation Report review and approval cycle, and Figure D-15 for the complete OT Accreditation Plan review and approval cycle.

9.1.4 ACCREDITATION GUIDANCE

Accreditation activities for new test capabilities generally consist of the following steps:

a) Describe the function and features of the test capability being accredited as well as the inputs and outputs.

b) Determine the intended use of the capability during testing.

c) Determine the test capability accreditation criteria. This may include documents such as the user manual, specification and design document or may include subject matter expertise.

d) Using known inputs, perform accreditation testing to exercise the capability, verifying and validating the functions and features according to the intended use for the test.

e) Compare the outputs of the accreditation testing against the accreditation criteria for the test capability and document the results.

In lieu of accreditation, an approved documented artifact (e.g., a prior Accreditation Report, test logs, as-run authenticated test procedures, test data, etc.) is required for established capabilities used in past testing or previously accredited capabilities. However, if the test capability or environment has changed, then the test capability requires re-accreditation in the new test environment.

The Accreditation Plan must describe the methods used to verify and validate the test capability and must also identify any supporting artifacts. Once a test capability has been accredited, it must be placed under CM in accordance with the CM Plan and monitored to ensure that the accreditation standards are maintained. The Accreditation Plan must document the conditions under which the test capability will require a re-accreditation process. Examples of such conditions include changes to the test capability algorithms, inputs or outputs.

Note: Refer to the V&V Repository for the Test Capability Accreditation template and the CM PDD.

9.2 IN-SERVICE REVIEW CHECKLIST AND DEPLOYMENT DECISION PLANNING

Deployment planning is part of a continuous In-Service Review (ISR) process that begins early in the lifecycle management process, usually during the development of requirements. A tailored ISR Checklist is used to ensure that all deployment and implementation issues are resolved prior to the In-Service Decision (ISD). This checklist will be used to: integrate

checklist issues with other emerging issues (such as PTRs from program tests and evaluation); develop action plans for resolution of checklist and other issues; and document decisions and the results of issue resolution and mitigation.

The service organization is responsible for developing, maintaining, and facilitating the ISR Checklist. T&E support for the ISR checklist is provided by test POCs and FAA SMEs, who tailor checklist items, provide action plans and status, and approve the Test Section of the ISR Checklist from the AMS Investment Analysis phase until the ISD. An FAA SME is a representative from the office to be contacted to provide expertise and additional information about a checklist item's intent and will concur with the closure of each checklist item. The FAA SME for test is the service organization test lead, which may be the DT or OT Test Director, or both. The test POC is the individual that provides a response to the checklist items. The test POC may also be the DT or OT Test Director, or an assigned test lead.

9.3 TEST NAS CHANGE PROPOSALS

Test NCPs are typically required for temporary configuration changes to existing baselined systems, including the installation of prototypes. FAA Order 1800.66 defines the Configuration Control Board approval process for test NCPs. FAA Order 6032.1B provides additional guidance on Test NCPs. The NCP approval process is lengthy and therefore, sufficient lead-time and preparation is necessary. In addition to the information referenced on the NCP, the case file documentation for a test modification must include:

a) The general method for accomplishing the modification, including:
    1) A description of system or system modification to be tested
    2) A description of connections and interfacing systems
    3) Descriptive diagrams as required
    4) An installation plan
b) The applicable PRD or requirement statement(s)
c) A test plan and specific test procedures, including:
    1) Test objectives
    2) Evaluation plan
    3) Test steps
    4) Expected or desired results
    5) Exit criteria
    6) Anticipated duration of test
d) A description of removal plan
e) An estimate of associated costs
f) A complete schedule of all planned tasks and activities

10 ACRONYMS

AMS	Acquisition Management System
APB	Acquisition Program Baseline
AT	Air Traffic
ATC	Air Traffic Control
ATO	Air Traffic Organization
CDR	Critical Design Review
CDRL	Contract Data Requirements List
CIF	CSCI Integration File/Folder
CM	Configuration Management
CMMI®	Capability Maturity Model® Integration
CMTP	Contractor Master Test Plan
CO	Contracting Officer
COI	Critical Operational Issue
CONOPs	Concept of Operations
COR	Contracting Officer's Representative
COTS	Commercial Off-the-Shelf
CPR	Critical Performance Requirement
CRD	Concept and Requirements Definition
CSC	Computer Software Component
CSCI	Computer Software Configuration Item
DID	Data Item Description
DMC	Document Management and Control
DR	Discrepancy Report
DR&A	Data Reduction and Analysis
DT	Development Test(ing)
ECP	Engineering Change Proposal
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
FAA	Federal Aviation Administration
FAT	Factory Acceptance Test(ing)
FCA	Functional Configuration Audit

FF	Field Familiarization
FID	Final Investment Decision
FQT	Functional Qualification Test(ing)
GA	Government Acceptance
GFE	Government Furnished Equipment
GFI	Government Furnished Information
GFP	Government Furnished Property
HB	Handbook
HF	Human Factors
HWCI	Hardware Configuration Item
I&I	Installation and Integration
IA	Investment Analysis
IAR	Interim Assessment Report
IARD	Investment Analysis Readiness Decision
IBR	Integrated Baseline Review
IDA	Investment Decision Authority
IID	Initial Investment Decision
IMS	Integrated Master Schedule
IOA	Independent Operational Assessment
IOARD	Independent Operational Assessment Readiness Declaration
IOC	Initial Operational Capability
iPRD	Initial Program Requirements Document
ISD	In-Service Decision
ISM	In-Service Management
ISO	International Organization for Standardization
ISPD	Implementation Strategy and Planning Document
ISR	In-Service Review
ITDP	Integration and Test Development Plan
ITT	Integrated Test Team
JRC	Joint Resources Council
KSN	Knowledge Services Network
LRU	Line Replaceable Unit
MOE	Measure of Effectiveness

MOP	Measure of Performance
MOS	Measure of Suitability
NAATS	National Association of Air Traffic Specialists
NAS	National Airspace System
NATCA	National Air Traffic Controllers Association
NCP	NAS Change Proposal
NDI	Non-Developmental Item
NextGen	Next Generation Air Transportation System
OCD	Operational Capability Demonstration
ORD	Operational Readiness Demonstration
OCT	Operational Capability Test
OT	Operational Test(ing)
PASS	Professional Airways System Specialists
PAT	Production Acceptance Test(ing)
PBSA	Performance-Based Service Acquisition
PCA	Physical Configuration Audit
PDD	Process Description Document
PDR	Preliminary Design Review
PM	Project Management
POC	Point of Contact
pPRD	preliminary Program Requirements Document
PRD	Program Requirements Document
PTR	Program Trouble Report
PWS	Performance Work Statement
QA	Quality Assurance
QMS	Quality Management System
QRO	Quality Reliability Officer
RMA	Reliability, Maintainability, and Availability
SAT	Site Acceptance Testing
SCAP	Security Certification and Authorization Package
SEM	System Engineering Manual
SEWG	System Engineering Working Group
SI	Solution Implementation

SIR	Screening Information Request
SME	Subject Matter Expert
SOO	Statement of Objectives
SOW	Statement of Work
SRR	System Requirements Review
T&E	Test and Evaluation
TEMP	Test and Evaluation Master Plan
TRR	Test Readiness Review
TRRG	Test Roles and Responsibilities Guide
TSB	Test Standards Board
TSI	Technical Strategies and Integration
TWG	Test Working Group
V&V	Verification and Validation
VRTM	Verification Requirements Traceability Matrix
WBS	Work Breakdown Structure
WJHTC	William J. Hughes Technical Center

APPENDIX A. TEST PLANNING PROCESS CONFORMANCE CHECKLIST

Test Program:
T&E Team(s):
T&E First Line Supervisor(s):
DT Test Director:
OT Test Director:

Version [1]: ____ Initial ____ Revision ____ Checklist Complete

Review Signatures: Date:

_____ _____
T&E First Line Supervisor(s)

_____ _____
DT Test Director

_____ _____
OT Test Director

_____ _____
TSB Representative

Note 1: Initial – Checklist will be filled out upon notification/assignment to a new T&E project, w/anticipated action tailoring included; Dated and signed
Revision – Checklist will be updated each time a changed, newly anticipated or actual but not previously anticipated tailored action is required; Dated and signed for each revision
Checklist Complete – Checklist will be finalized when the associated program phase is complete and all actions have been addressed; Dated and signed

APPENDIX A. TEST PLANNING PROCESS CONFORMANCE CHECKLIST

Test Program Name: _____ **Version Date [6]:** _____

Action ID	Action	TSB Role	T&E HB Ref. Sec.	Tailoring Change(s) w/ Justification (if used) [2]	Target Date [3]	Completion Date [4]	Status/ Comments/ Artifacts [5]
TP1	Participate in early product engineering and implementation reviews	Monitor	5.1(a)				
TP2	Provide test strategy briefings to the Program Office	Monitor	5.1(g)(2)				
TP3	Review the PRD for: - Requirement completeness - Definition of NAS operational interfaces - Requirement testability - COI completeness and testability - Identification of CPRs - Test program structure	Monitor	 5.1(b) 5.1(c) 5.1(d) 5.1(e) 5.1(f) 5.1(g)				
TP4	Write the T&E section of the PRD, to include essential FAA and contractor tests, and follow the review & approval cycle for submission into the PRD	Monitor	5.1(g)(3), 1.9(a), Fig. D-1				
TP5	Form (with the Program Office) and participate in the Integrated Test Team (ITT), beginning with ISPD and TEMP planning	Monitor	5.2, 5.3, 7.3.2				

APPENDIX A. TEST PLANNING PROCESS CONFORMANCE CHECKLIST

Test Program Name: _____ **Version Date [6]:** _____

Action ID	Action	TSB Role	T&E HB Ref. Sec.	Tailoring Change(s) w/ Justification (if used) [2]	Target Date [3]	Completion Date [4]	Status/ Comments/ Artifacts [5]
TP6	Write the T&E section of the ISPD, to include test strategy, test schedule and test resource requirements, and follow the review & approval cycle for submission into the ISPD	Monitor	5.2, 1.9(b), Fig. D-2				
TP7	Review, witness and document any early evaluations (e.g., prototype tests, user demos, OCDs, OCTs)	Monitor	4				
TP8	Write the initial and final TEMP, utilizing the Test Design process: - Identify and assess requirements - Identify and decompose COIs into MOEs, MOSs and MOPs - Identify CPRs - Define DT and OT test activities - Develop the TEMP VRTM - Identify Test Capability Requirements - Define test schedule and costs - Update the APB (if required) - Document the test design in the TEMP	Review	5.3.3 5.3.3.1 5.3.3.2 5.3.3.3 5.3.3.4 5.3.3.5 5.3.3.6 5.3.3.7 5.3.3.8 5.3.3.9				
TP9	Provide a briefing to the Program Manager for concurrence on the T&E approach prior to submitting the initial and final TEMP for Program Manager review and approval	Monitor	5.3				

APPENDIX A. TEST PLANNING PROCESS CONFORMANCE CHECKLIST

Test Program Name: _____ **Version Date [6]:** _____

Action ID	Action	TSB Role	T&E HB Ref. Sec.	Tailoring Change(s) w/ Justification (if used) [2]	Target Date [3]	Completion Date [4]	Status/ Comments/ Artifacts [5]
TP10	Tailor and approve the Test Section of the In-Service Review (ISR) Checklist	Monitor	9.2				
TP11	Identify if there is a need for test NCPs in the TEMP. If so, provide the required NCP/case file documentation in accordance with FAA Orders 1800.66 and 6032.1B	Monitor	9.3				

APPENDIX A. TEST PLANNING PROCESS CONFORMANCE CHECKLIST

Test Program Name: _____ **Version Date [6]:** _____

Action ID	Action	TSB Role	T&E HB Ref. Sec.	Tailoring Change(s) w/ Justification (if used) [2]	Target Date [3]	Completion Date [4]	Status/ Comments/ Artifacts [5]
TP12	If required, develop test program accreditation requirements (prime contractor for DT, OT Test Director for OT) and document in the TEMP: - For DT, review the prime contractor's Accreditation Plan(s) and follow the DT Accreditation Plan review & approval cycle prior to providing a final approval recommendation to the CO and; For OT, develop an Accreditation Plan(s) and follow the OT Accreditation Plan review & approval cycle - Witness prime contractor accreditation activities for DT, and/or conduct accreditation activities for OT; Provide analysis and results for approval no later than 30 days prior to testing using the simulation - For DT, review the prime contractor's Accreditation Report and follow the DT Accreditation Report review & approval cycle prior to providing a final approval recommendation to the CO. For OT, write an Accreditation Report and follow the OT Accreditation Report review & approval cycle - Archive the Accreditation Plan(s), analysis, and Accreditation Report(s)	Review	9.1, 9.1.3, Fig. D-14, Fig. D-15				
TP13	Follow the review & approval cycle for all versions of the TEMP that require approval signatures	Review	5.3, 1.9(c), Fig. D-3				

APPENDIX A. TEST PLANNING PROCESS CONFORMANCE CHECKLIST

Test Program Name: _____ **Version Date [6]:** _____

Action ID	Action	TSB Role	T&E HB Ref. Sec.	Tailoring Change(s) w/ Justification (if used) [2]	Target Date [3]	Completion Date [4]	Status/ Comments/ Artifacts [5]
TP14	Update the TEMP at major milestones, when the ISPD has been significantly modified, or when the program is significantly changed or restructured	Review	5.3, 5.3.2				

Note 2: Tailoring – Identify any required change(s) to the Action, and provide justification for each specific change (Sec. 1.6 of this T&E handbook can be used to provide justifications related to tailoring the T&E process); Leave blank if no tailoring is required

Note 3: Target Date – Provide at least the month and year of the anticipated completion of the Action; Revise only when a major program schedule change has occurred; Leave blank if the Action already occurred prior to the completion of the Initial version of the checklist

Note 4: Completion Date – Provide the actual completion date of the Action; If the Action was completed prior to the completion of the Initial version of the checklist, provide at least the year of the Action completion or leave blank if unknown; If the Action is completed after the completion of the Initial version of the checklist, provide the full date of the Action completion (month/day/year); For Actions that have multiple items to complete, provide completion dates for each item and explain in the Status/Comments column

Note 5: Status/Comments – Provide any supporting information for the Action; If the Action was completed prior to the completion of the Initial version of the checklist and the actual date of completion is unknown, enter the words "Action occurred prior to the implementation of this T&E process" in this column

Note 6: Each signed and dated version (Initial, Revisions, and Checklist Complete) of this checklist will be maintained by the DT Test Director in either a hard copy or in an electronic copy with a scanned signature page. Each "working copy" of this checklist can be maintained electronically on the DT Test Director's PC. All signed and dated versions of this checklist will be maintained for a period of two (2) years beyond the completion of the OT Checklist and in accordance with the ANG-E Document Management and Control (DMC) Process Description Document (PDD)

APPENDIX B. DT PROCESS CONFORMANCE CHECKLIST

Test Program:

T&E Team(s):

T&E First Line Supervisor(s):

DT Test Director:

Version [1]: ____ Initial ____ Revision ____ Checklist Complete

Review Signatures: Date:

_____ _____

T&E First Line Supervisor(s)

_____ _____

DT Test Director

_____ _____

TSB Representative

Note 1: Initial – Checklist will be filled out upon notification/assignment to a new T&E project, w/anticipated action tailoring included; Dated and signed

Revision – Checklist will be updated each time a changed, newly anticipated or actual but not previously anticipated tailored action is required; Dated and signed for each revision

Checklist Complete – Checklist will be finalized when the associated program phase is complete and all actions have been addressed; Dated and signed

APPENDIX B. DT PROCESS CONFORMANCE CHECKLIST

Test Program Name: _____ **Version Date [6]:** _____

Action ID	Action	TSB Role	T&E HB Ref. Sec.	Tailoring Change(s) w/ Justification (if used) [2]	Target Date [3]	Completion Date [4]	Status/ Comments/ Artifacts [5]
DT1	Support development of the FAA System Specification, and ensure that all test-related inputs are peer-reviewed prior to submission	Monitor	5.4, 1.9(d)				
DT2	Support development of the SIR proposal and SOW/PWS/SOO requirements, ensuring that adequate test requirements and test activities are included, and that these inputs are peer-reviewed prior to submission	Monitor	5.5, 6.1.3.1, 1.9(e), 1.9(f)				
DT3	Review/evaluate the contractor proposals	Monitor	5.6				
DT4	Coordinate with the CO and to provide test-related contract support	N/A	6.1.3				
DT5	After confirming that they have undergone internal contractor peer reviews, review and comment on contractor specifications (A-Level & B-Level) and other test-related CDRL documents	Monitor	6.1.3.2, 6.1.3.3				
DT6	Provide status and action plans for ISR Checklist test-related items	Monitor	9.2				
DT7	Participate in and provide test expertise to system engineering, hardware, and software meetings and reviews	Monitor	6.1.4				

APPENDIX B. DT PROCESS CONFORMANCE CHECKLIST

Test Program Name: _____ **Version Date [6]:** _____

Action ID	Action	TSB Role	T&E HB Ref. Sec.	Tailoring Change(s) w/ Justification (if used) [2]	Target Date [3]	Completion Date [4]	Status/ Comments/ Artifacts [5]
DT8	Review the CMTP (including the DT VRTM) and follow the review & approval cycle prior to providing an approval recommendation to the CO and	Review	6.1.3.2, 6.2.2, 6.2.3, Fig. D-4				
DT9	Participate in TWG meetings with the Contractor Test Manager for DT test program planning and issues resolution	N/A	6.2				
DT10	Determine the verification method for any COTS/NDI hardware, software, and firmware	Monitor	6.2.1.1				
DT11	Witness accreditation of DT test capabilities	N/A	6.2.1.10, 9.1				
DT12	Participate in system training from the contractor and T&E process training as needed, and maintain training records as required	Monitor	6.2.1.12				
DT13	Review the contractor's DT Test Plan(s) and follow the review & approval cycle prior to providing an approval recommendation to the CO and	Review	6.2.5, Fig. D-5				
DT14	Review the contractor's DT Test Procedures and follow the review & approval cycle prior to providing an approval recommendation to the CO and	Monitor	6.2.6, Fig. D-6				

APPENDIX B. DT PROCESS CONFORMANCE CHECKLIST

Test Program Name: _____ **Version Date [6]:** _____

Action ID	Action	TSB Role	T&E HB Ref. Sec.	Tailoring Change(s) w/ Justification (if used) [2]	Target Date [3]	Completion Date [4]	Status/ Comments/ Artifacts [5]
DT15	Ensure that all DT entrance criteria have been met prior to entering formal DT	Monitor	6.2.7				
DT16	Witness DT dry run testing prior to each formal DT test activity	Monitor	6.3, 6.3.1				
DT17	Participate in a contractor-conducted TRR prior to each formal DT test activity	Monitor	6.3, 6.3.2				
DT18	Participate in Pre-Test Briefings prior to each test, and review and approve any planned test deviations	Monitor	6.3.3				
DT19	Witness DT Software Testing	Monitor	6.2.1.2				
DT20	Witness DT Hardware Testing	Monitor	6.2.1.3				
DT21	Witness Factory Acceptance Testing (FAT)	Monitor	6.2.1.4				
DT22	Monitor Functional Qualification Testing (FQT)	Monitor	6.2.1.5				
DT23	Witness DT Installation and Integration (I&I) Testing	Monitor	6.2.1.6				
DT24	Complete a System Test Entrance Checklist to assess DT issues and test readiness prior to entering DT System Testing, and submit it to the T&E First Line Supervisor for endorsement and the TSB for review and comment	Review	6.2.1.7				

APPENDIX B. DT PROCESS CONFORMANCE CHECKLIST

Test Program Name: _____ **Version Date [6]:** _____

Action ID	Action	TSB Role	T&E HB Ref. Sec.	Tailoring Change(s) w/ Justification (if used) [2]	Target Date [3]	Completion Date [4]	Status/ Comments/ Artifacts [5]
DT25	Witness DT System Testing	Monitor	6.2.1.7				
DT26	Witness Production Acceptance Testing (PAT)	Monitor	6.2.1.8				
DT27	Witness Site Acceptance Testing (SAT) (Coordinate with each facility prior to SAT)	Monitor	6.2.1.9				
DT28	During all formal DT test execution: - Sign off/initial all test procedure changes/redlines/deviations - Ensure that anomalies are properly documented in the contractor's test log - Sign off on the test log and obtain copies of the test log and as-run test procedures at the completion of testing	Monitor	6.3.4				
DT29	Participate in DT Post-Test Reviews after each test, and review and confirm results	Monitor	6.3.5				
DT30	Prepare, distribute to the DT test team, and enter into the test status database a Test Status Report for each dry run and formal test run	Monitor	6.3.6				

APPENDIX B. DT PROCESS CONFORMANCE CHECKLIST

Test Program Name: _____ **Version Date [6]:** _____

Action ID	Action	TSB Role	T&E HB Ref. Sec.	Tailoring Change(s) w/ Justification (if used) [2]	Target Date [3]	Completion Date [4]	Status/ Comments/ Artifacts [5]
DT31	Review the contractor's PTR database, including: - Review and approve the PTR database design - Review and concur on PTR priorities - Review and concur on PTR corrective actions and proposed regression testing	Monitor	6.3.7				
DT32	Approve the extent of and witness any DT Regression Testing	Monitor	6.3.8				
DT33	Review the contractor's DT Test Report and follow the review & approval cycle prior to providing an approval recommendation to the CO and	Review	6.4, Fig. D-7				
DT34	Support the FCA, PCA, and GA processes with test expertise and verification	Monitor	6.1.3.4				
DT35	Ensure that all DT exit criteria have been met prior to exiting DT	Monitor	6.2.8				

Note 2: Tailoring – Identify any required change(s) to the Action, and provide justification for each specific change (Sec. 1.6 of this T&E handbook can be used to provide justifications related to tailoring the T&E process); Leave blank if no tailoring is required

Note 3: Target Date – Provide at least the month and year of the anticipated completion of the Action; Revise only when a major program schedule change has occurred; Leave blank if the Action already occurred prior to the completion of the Initial version of the checklist

Note 4: Completion Date – Provide the actual completion date of the Action; If the Action was completed prior to the completion of the Initial version of the checklist, provide at least the year of the Action completion or leave blank if unknown; If the Action is completed after the completion of the Initial version of the checklist, provide the full date of the Action completion (month/day/year); For Actions that have multiple items to complete, provide completion dates for each item and explain in the Status/Comments column

Note 5: Status/Comments – Provide any supporting information for the Action; If the Action was completed prior to the completion of the Initial version of the checklist and the actual date of completion is unknown, enter the words "Action occurred prior to the implementation of this T&E process" in this column

Note 6: Each signed and dated version (Initial, Revisions, and Checklist Complete) of this checklist will be maintained by the DT Test Director in either a hard copy or in an electronic copy with a scanned signature page. Each "working copy" of this checklist can be maintained electronically on the DT Test Director's PC. All signed and dated versions of this checklist will be maintained for a period of two (2) years beyond the completion of the OT Checklist and in accordance with the ANG-E Document Management and Control (DMC) Process Description Document (PDD)

APPENDIX C. OT PROCESS CONFORMANCE CHECKLIST

Test Program:
T&E Team(s):
T&E First Line Supervisor(s):
OT Test Director:

Version [1]: ____ Initial ____ Revision ____ Checklist Complete

Review Signatures:	Date:
_____	_____
T&E First Line Supervisor(s)	
_____	_____
OT Test Director	
_____	_____
TSB Representative	

Note 1: Initial – Checklist will be filled out upon notification/assignment to a new T&E project, w/anticipated action tailoring included; Dated and signed

Revision – Checklist will be updated each time a changed, newly anticipated or actual but not previously anticipated tailored action is required; Dated and signed for each revision

Checklist Complete – Checklist will be finalized when the associated program phase is complete and all actions have been addressed; Dated and signed

APPENDIX C. OT PROCESS CONFORMANCE CHECKLIST

Test Program Name: _____ **Version Date [6]:** _____

Action ID	Action	TSB Role	T&E HB Ref. Sec.	Tailoring Change(s) w/ Justification (if used) [2]	Target Date [3]	Completion Date [4]	Status/ Comments/ Artifacts [5]
OT1	Work with the ITT to define personnel and resource requirements for OT, including assigning test leads	Monitor	7.3.1				
OT2	Support development of the FAA System Specification from an operational perspective	Monitor	5.4				
OT3	Support development of the SIR proposal and SOW/PWS/SOO requirements, ensuring that adequate OT support requirements are included, and that these inputs are peer-reviewed prior to submission	Monitor	5.5, 7.3.3, 1.9(e), 1.9(f)				
OT4	Evaluate contractor proposals from the OT perspective	Monitor	5.6				
OT5	Provide OT test-related contract support, including inputs to the SOW/PWS/SOO and participation in specification, CDRL, and program reviews	N/A	7.3.3				
OT6	Provide status and action plans for ISR Checklist test-related items	Monitor	9.2				
OT7	Participate in system training from the contractor and T&E process training as needed, and maintain training records as required	Monitor	7.3.4				
OT8	Coordinate early during the T&E Planning and Support phase with OT field participants	Monitor	7.3.5				

APPENDIX C. OT PROCESS CONFORMANCE CHECKLIST

Test Program Name: _____ **Version Date [6]:** _____

Action ID	Action	TSB Role	T&E HB Ref. Sec.	Tailoring Change(s) w/ Justification (if used) [2]	Target Date [3]	Completion Date [4]	Status/ Comments/ Artifacts [5]
OT9	Plan and perform accreditation of OT test capabilities	Monitor	7.3.6, 9.1				
OT10	Participate in DT TWG meetings with the Contractor Test Manager and DT Test Director for test program planning and resolution of issues that may affect OT	Monitor	6.2				
OT11	Prior to OT, generate DRs for all issues discovered that impact operational requirements but are not being addressed and need to be evaluated during OT	Monitor	7.6.4				
OT12	Develop the OT Test Plan (including the OT VRTM) and follow the review & approval cycle prior to final distribution	Review	7.4.1, 7.4.2, 1.9(g), Fig. D-8				
OT13	Meet with the ITT and ensure that all OT entrance criteria have been met prior to entering the OT phase	Monitor	7.4.3, 7.6				

APPENDIX C. OT PROCESS CONFORMANCE CHECKLIST

Test Program Name: _____ **Version Date [6]:** _____

Action ID	Action	TSB Role	T&E HB Ref. Sec.	Tailoring Change(s) w/ Justification (if used) [2]	Target Date [3]	Completion Date [4]	Status/ Comments/ Artifacts [5]
OT14	Collect, analyze, and report (using the OT IAR) at major milestones on system performance, requirements, issues, and risks having an operational impact during system development, DT, and OT - Generate optional IARs (minimally at required milestones) and follow the review & approval cycle prior to distribution - Electronically distribute completed IARs to the respective T&E Senior Manager, Program Manager, TSI Senior Manager, and TSB	Review	5.3.3.10, 7.7.1, Fig. D-10				
OT15	Generate the OT Test Procedures, including: - Develop the draft OT test procedures (including checkout and debugging) and follow the review & approval cycle - Dry run the OT Test Procedures (dry runs should include OT field participants)	Review	7.5, 7.5.1, 1.9(h), Fig. D-9				
OT16	Maintain an OT Test Procedures Status Matrix during OT test procedure development, and generate a Test Status Report at the conclusion of each test activity (checkout, debug, and dry run) and provide it to the ITT	Monitor	7.5.3				
OT17	Develop OT user-evaluation questionnaires and submit them to the appropriate union(s) for approval prior to use during formal OT	Monitor	7.5.2				

APPENDIX C. OT PROCESS CONFORMANCE CHECKLIST

Test Program Name: _____ **Version Date [6]:** _____

Action ID	Action	TSB Role	T&E HB Ref. Sec.	Tailoring Change(s) w/ Justification (if used) [2]	Target Date [3]	Completion Date [4]	Status/ Comments/ Artifacts [5]
OT18	Coordinate all required logistical activities for OT prior to the TRR	N/A	7.6.1				
OT19	Conduct the OT TRR prior to the start of formal OT activities	Monitor	7.6.2				
OT20	Conduct an OT Pre-Test Briefing prior to the start of each OT test	N/A	7.6.3.1				
OT21	During all formal OT test executions: - Maintain a test log - Collect completed questionnaires (if used) immediately following the test execution - Generate DRs for all issues/anomalies encountered during the testing	Monitor	7.6.3.2, 7.6.4				
OT22	Conduct an OT Post-Test Review at the conclusion of each formal OT test	N/A	7.6.3.3				
OT23	Generate a Test Status Report at the conclusion of each formal OT test	Monitor	7.6.3.3				
OT24	Conduct DR reviews on a regular basis and maintain the DR database	N/A	7.6.4				
OT25	Generate an OT Problem Traceability Matrix to identify the COIs, MOEs, MOSs, and CPRs impacted by the open DRs and PTRs	Monitor	7.6.5				

APPENDIX C. OT PROCESS CONFORMANCE CHECKLIST

Test Program Name: _____ **Version Date [6]:** _____

Action ID	Action	TSB Role	T&E HB Ref. Sec.	Tailoring Change(s) w/ Justification (if used) [2]	Target Date [3]	Completion Date [4]	Status/ Comments/ Artifacts [5]
OT26	Conduct an OT Caucus after the completion of formal OT testing, including: - Review the OT Problem Traceability Matrix to assess the operational impact of open DRs and PTRs - Generate an OT Caucus Summary Report to document the status of each COI, MOE, MOS, and CPR, and to support the resolution of critical PTRs	Monitor	7.6.5				
OT27	Generate an OT Quicklook Test Report, including: - Generate the draft report and follow the review & approval cycle prior to distribution - Electronically distribute the approved OT Quicklook Test Report to the respective T&E Senior Manager, Program Manager, TSI Senior Manager, Technical Center Director, and TSB within 15 calendar days from test completion	Review	7.7.2, Fig. D-11				
OT28	Conduct OT Regression Testing to verify the integrity of solutions to DRs/PTRs	Monitor	7.6.6				
OT29	Ensure that all OT exit criteria have been met prior to exiting OT	Monitor	7.4.4				

APPENDIX C. OT PROCESS CONFORMANCE CHECKLIST

Test Program Name: _____ **Version Date [6]:** _____

Action ID	Action	TSB Role	T&E HB Ref. Sec.	Tailoring Change(s) w/ Justification (if used) [2]	Target Date [3]	Completion Date [4]	Status/ Comments/ Artifacts [5]
OT30	Generate an OT Final Test Report, including: - For large or high-risk programs, conduct an OT Final Test Report Out-Brief to the ITT prior to delivering the draft report for review - Follow the OT Final Test Report review and approval cycle prior to final distribution, including an OT Final Test Report Out-Brief to the Technical Center Director, if required. - Deliver the approved OT Final Test Report within 60 calendar days from test completion to the TSB, the Program Manager, and the ANG Assistant Administrator for NextGen, ANG-1, to support the ISD process	Review	7.7.3, 1.9(i), Fig. D-12				
OT31	Provide an OT Final Test Report Out-Brief, as required, to the ANG Assistant Administrator for NextGen, ANG-1, prior to the ISD milestone (Technical Center Director function)	Monitor	7.7.3				
OT32	If required, provide test support to the In-Service Management (ISM) organization during the transitional period from OT to ISM	Monitor	7.8				
OT33	If required, develop a Field Familiarization (FF) Support Plan and provide it to the TSB for review and comment prior to final delivery to the Program Office and site representatives	Review	7.9, 7.9.1 Fig. D-13				

APPENDIX C. OT PROCESS CONFORMANCE CHECKLIST

Test Program Name: _____ **Version Date [6]:** _____

Action ID	Action	TSB Role	T&E HB Ref. Sec.	Tailoring Change(s) w/ Justification (if used) [2]	Target Date [3]	Completion Date [4]	Status/ Comments/ Artifacts [5]
OT34	If required, develop and dry run FF test procedures	Monitor	7.9.1, 7.9.2				
OT35	If required, participate in FF testing, including all activities associated with formal testing	Monitor	7.9.3				
OT36	If required, generate and distribute to the Program Office, TSB, and site representatives a final FF Report for each site to document the activities and summarize any issues encountered during FF testing	Review	7.9.4				

Note 2: Tailoring – Identify any required change(s) to the Action, and provide justification for each specific change (Sec. 1.6 of this T&E handbook can be used to provide justifications related to tailoring the T&E process); Leave blank if no tailoring is required

Note 3: Target Date – Provide at least the month and year of the anticipated completion of the Action; Revise only when a major program schedule change has occurred; Leave blank if the Action already occurred prior to the completion of the Initial version of the checklist

Note 4: Completion Date – Provide the actual completion date of the Action; If the Action was completed prior to the completion of the Initial version of the checklist, provide at least the year of the Action completion or leave blank if unknown; If the Action is completed after the completion of the Initial version of the checklist, provide the full date of the Action completion (month/day/year); For Actions that have multiple items to complete, provide completion dates for each item and explain in the Status/Comments column

Note 5: Status/Comments – Provide any supporting information for the Action; If the Action was completed prior to the completion of the Initial version of the checklist and the actual date of completion is unknown, enter the words "Action occurred prior to the implementation of this T&E process" in this column

Note 6: Each signed and dated version (Initial, Revisions, and Checklist Complete) of this checklist will be maintained by the OT Test Director in either a hard copy or in an electronic copy with a scanned signature page. Each "working copy" of this checklist can be maintained electronically on the OT Test Director's PC. All signed and dated versions of this checklist will be maintained for a period of two (2) years beyond the completion of the OT Checklist and in accordance with the ANG-E Document Management and Control (DMC) Process Description Document (PDD)

APPENDIX D. T&E WORK PRODUCTS AND REVIEW PROCESS CYCLES

The following table identifies the major work products associated with each phase of the T&E process, along with a reference to their associated review and approval cycle flow diagrams which are contained in this appendix.

TABLE D-1. T&E WORK PRODUCTS

Test Phase	Work Product	TSB Early Review Cycle [1]	TSB Final Review Required [2]	TSB Endorsement Required [3]	Flow Diagram Number
T&E Program Planning	Program Requirements Document (PRD) T&E Section	X	X		D-1
	Implementation Strategy and Planning Document (ISPD) T&E Section (Requires WJHTC Director Approval)	X	X	X	D-2
	Test and Evaluation Master Plan (TEMP) (Requires WJHTC Director Approval)	X	X	X	D-3
Development Test (DT)	Contractor Master Test Plan (CMTP)		X		D-4
	DT Test Plan		X		D-5
	DT Test Procedures	TSB's role is to monitor the test team activity			D-6
	DT Test Report		X		D-7
	DT Accreditation Plan/ DT Accreditation Report		X		D-14
Operational Test (OT)	OT Test Plan	X	X	X	D-8
	OT Test Procedures	TSB reviews as needed			D-9
	OT Interim Assessment Report (IAR)		X		D-10
	OT Quicklook Test Report		X		D-11
	OT Final Test Report (Requires WJHTC Director Approval)	X	X	X	D-12
	Field Familiarization Support Plan	X	X		D-13
	OT Test Capability Accreditation Plan	X	X	X	D-15

[1] An early review is performed for the purpose of identifying major work product deficiencies. This is typically accomplished by the project's TSB POC and one other TSB member.

[2] Work products are distributed to all board members for review and comment. The completed review results in a meeting in which the TSB determines the level of conformance to established standards and the TSB's position, if endorsable.

[3] Endorsement is defined as a recommendation for approval or disapproval of a work product with supporting comments. Endorsement can be accomplished via email, endorsement letter, or a written signature on the signature page of the document by the endorser(s).

The following pages contain diagrams of the process flow cycles for reviewing and approving the test work products identified in the handbook. The processes in the diagrams may be tailored to meet program needs. A process may be restarted if major revisions are required based on reviews or major program changes.

The following terminology is presented below for use in understanding the flow diagrams:

- Signature: On specified documents, signature(s) are required by the responsible author(s) of the document (normally the Test Director(s)) on the signature page.
- Review: A Review is defined as an assessment of a draft or final draft document to provide comments and input. The outcome of a review results in the delivery of a revised draft or a final document. A Peer Review is a structured type of review which involves a methodical examination of a completed draft document. Peer Reviews are conducted in accordance with the Peer Review PDD to ensure the quality of the work product. Peer Reviews are conducted by unbiased subject matter experts that have independence from the development and approval of the document. Peer reviewers utilize knowledge, experience, established standards and known best practices to provide editorial and technical comments.
- Endorsement: Endorsement is defined as a recommendation for approval or disapproval of a work product with supporting comments. Endorsement can be accomplished via email, endorsement letter, or a written signature on the signature page of the document by the endorser(s). Note: The TSB endorses work products via TSB Endorsement Position Papers.
- Approval: For DT work products, approval is defined by the provision of an approval recommendation from the DT Test Director to the Contracting Officer after all appropriate Government authorities have reviewed and endorsed the document. For OT work products, approval is defined by the written signature on the signature page of the document by the designated authority after his or her review and approval of the document.

The following symbology definitions are presented below for use in understanding the connector lines between the blocks in the flow diagrams:

- Solid line: ———— Mandatory path for activity to follow
- Dashed line: - - - - - - - - - - - - Recommended path for activity to follow

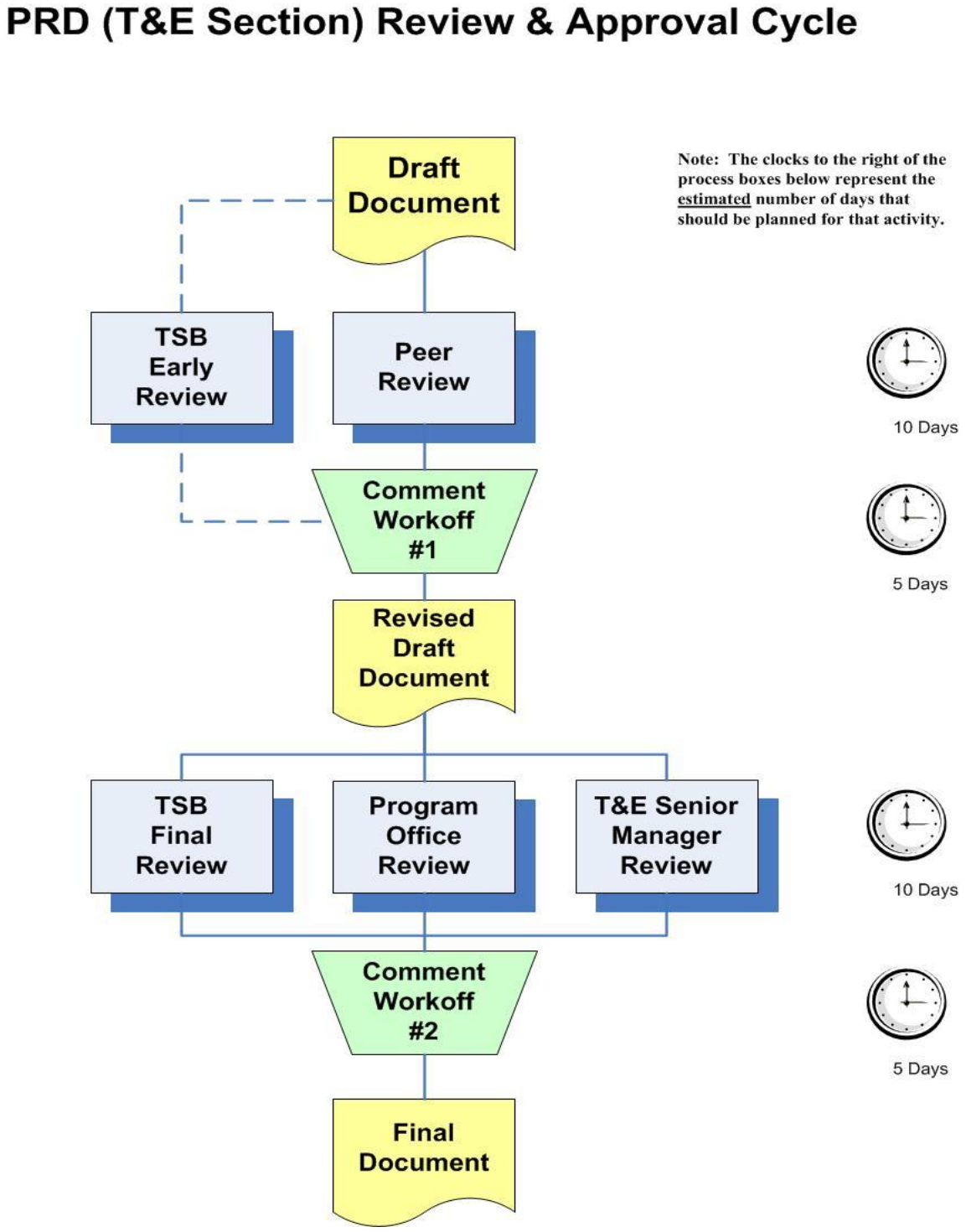

FIGURE D-1. PRD (T&E SECTION) REVIEW & APPROVAL CYCLE

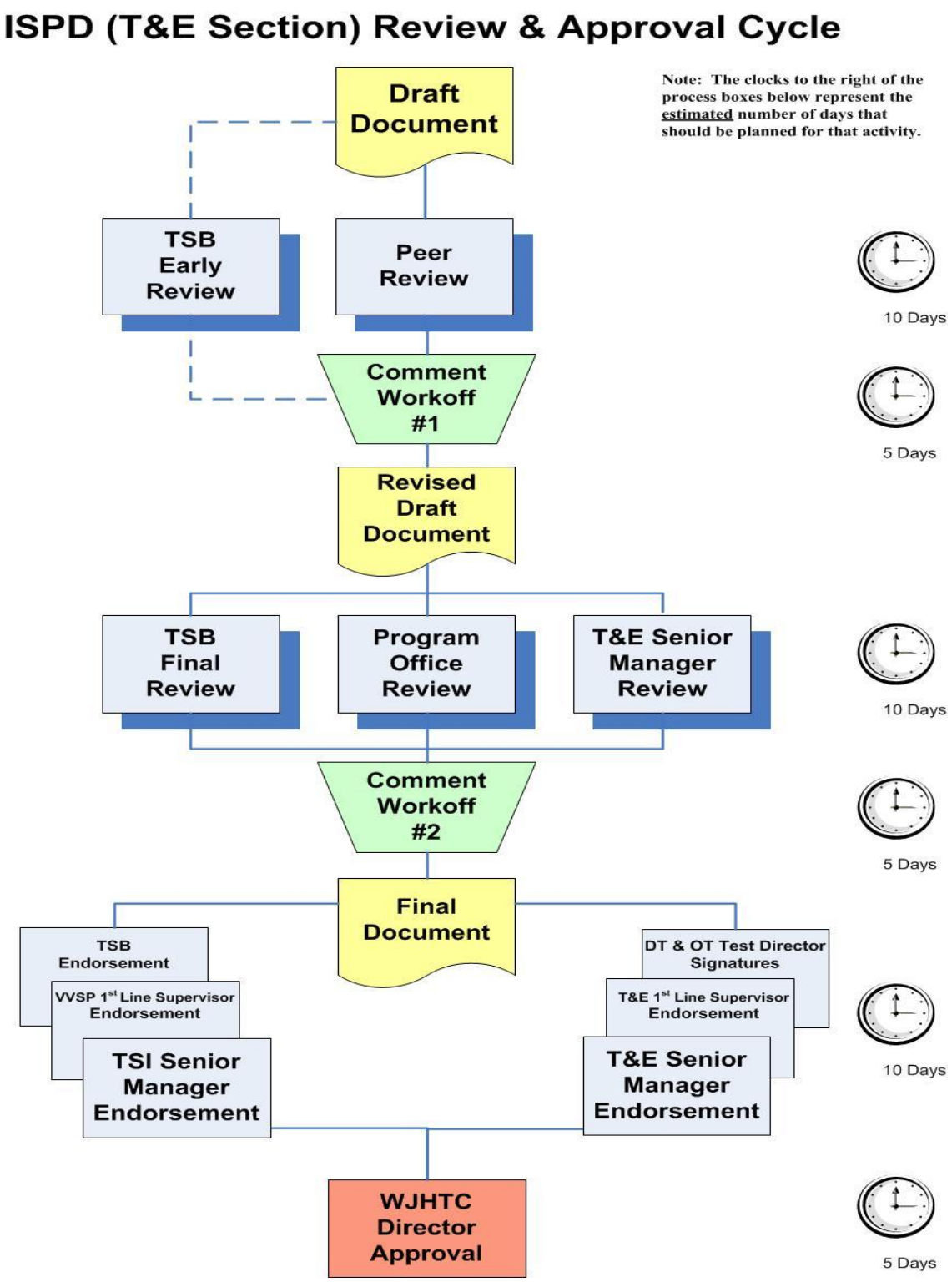

FIGURE D-2. ISPD (T&E SECTION) REVIEW & APPROVAL CYCLE

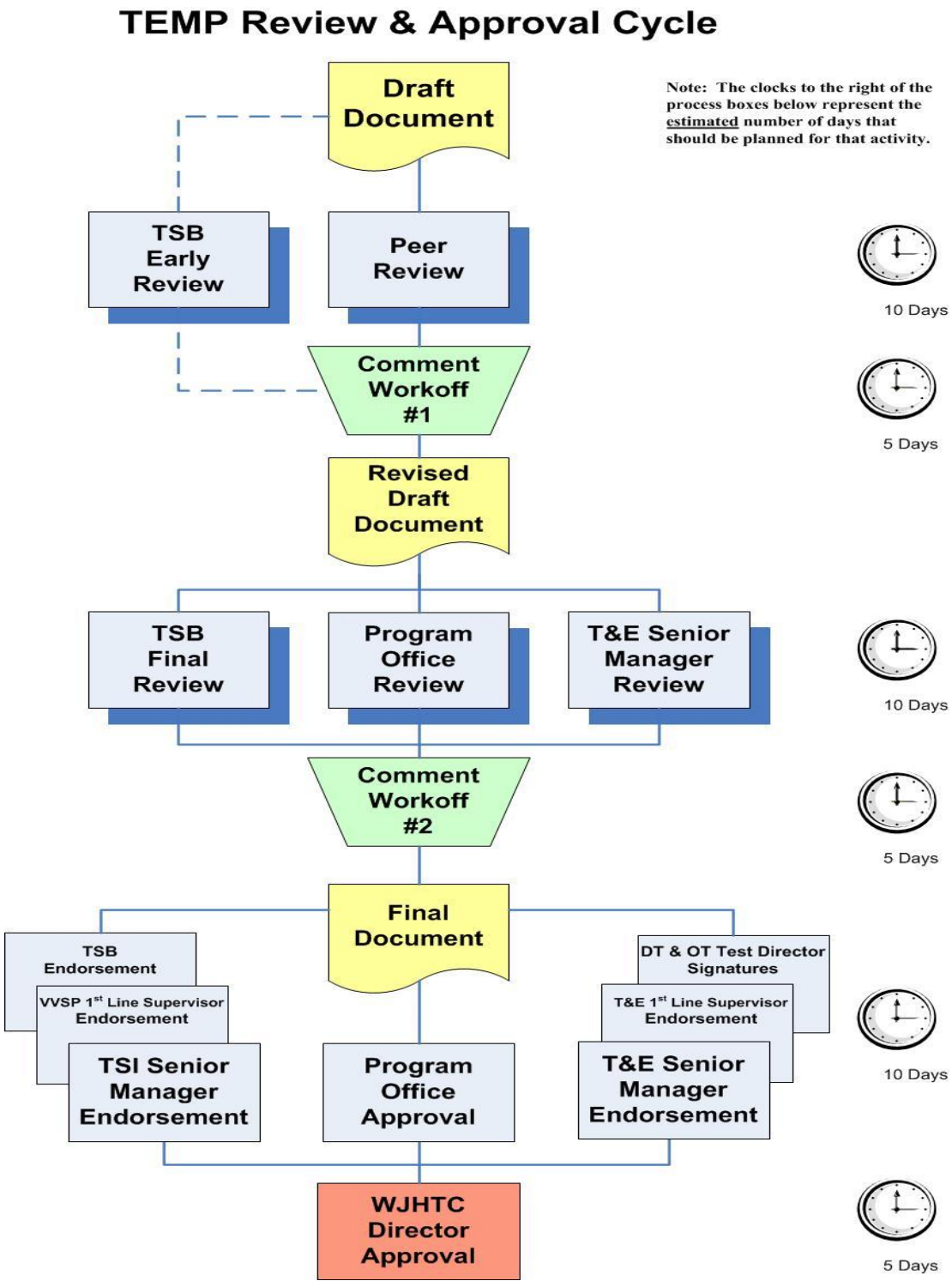

FIGURE D-3. TEMP REVIEW & APPROVAL CYCLE

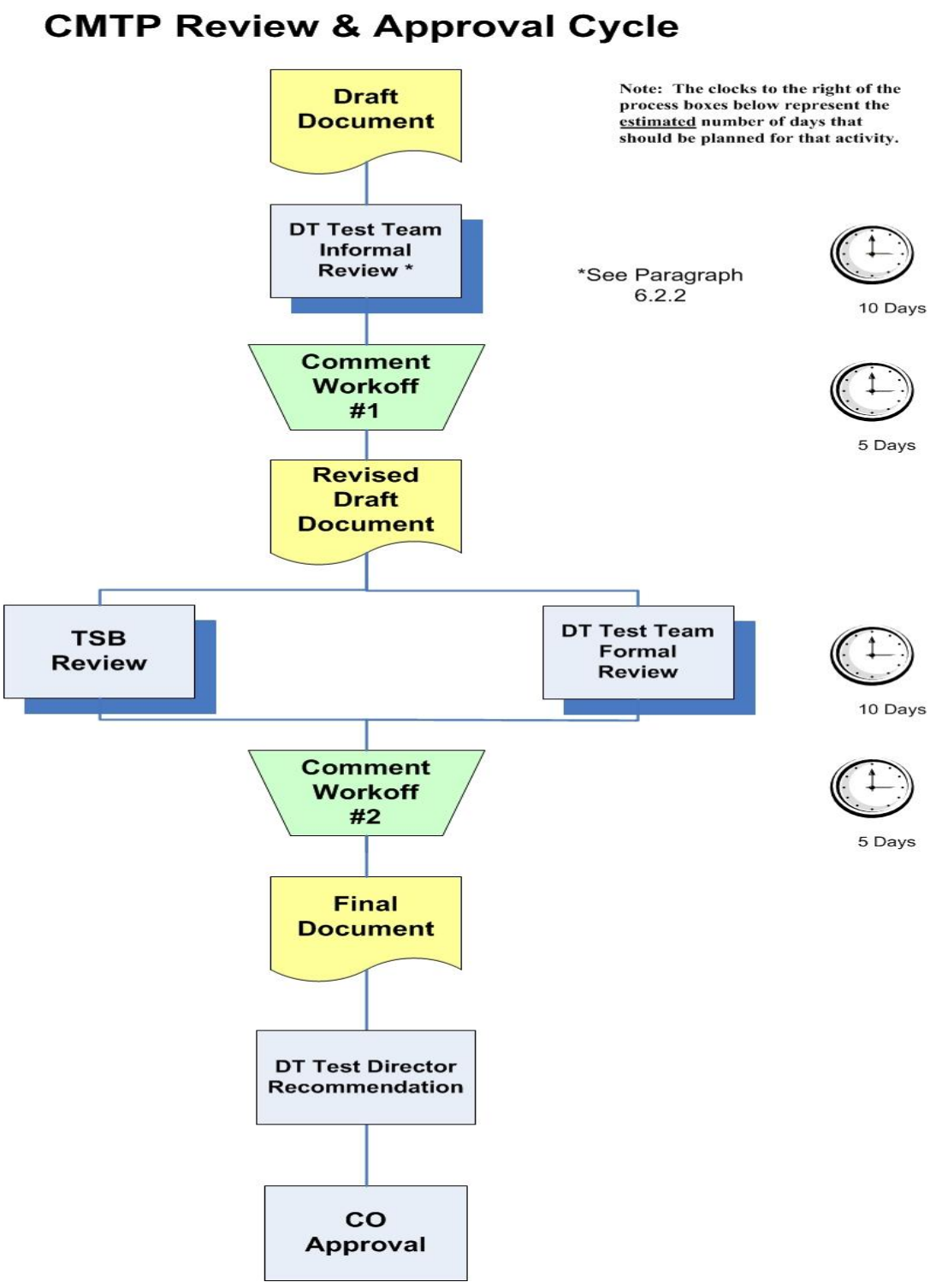

FIGURE D-4. CMTP REVIEW & APPROVAL CYCLE

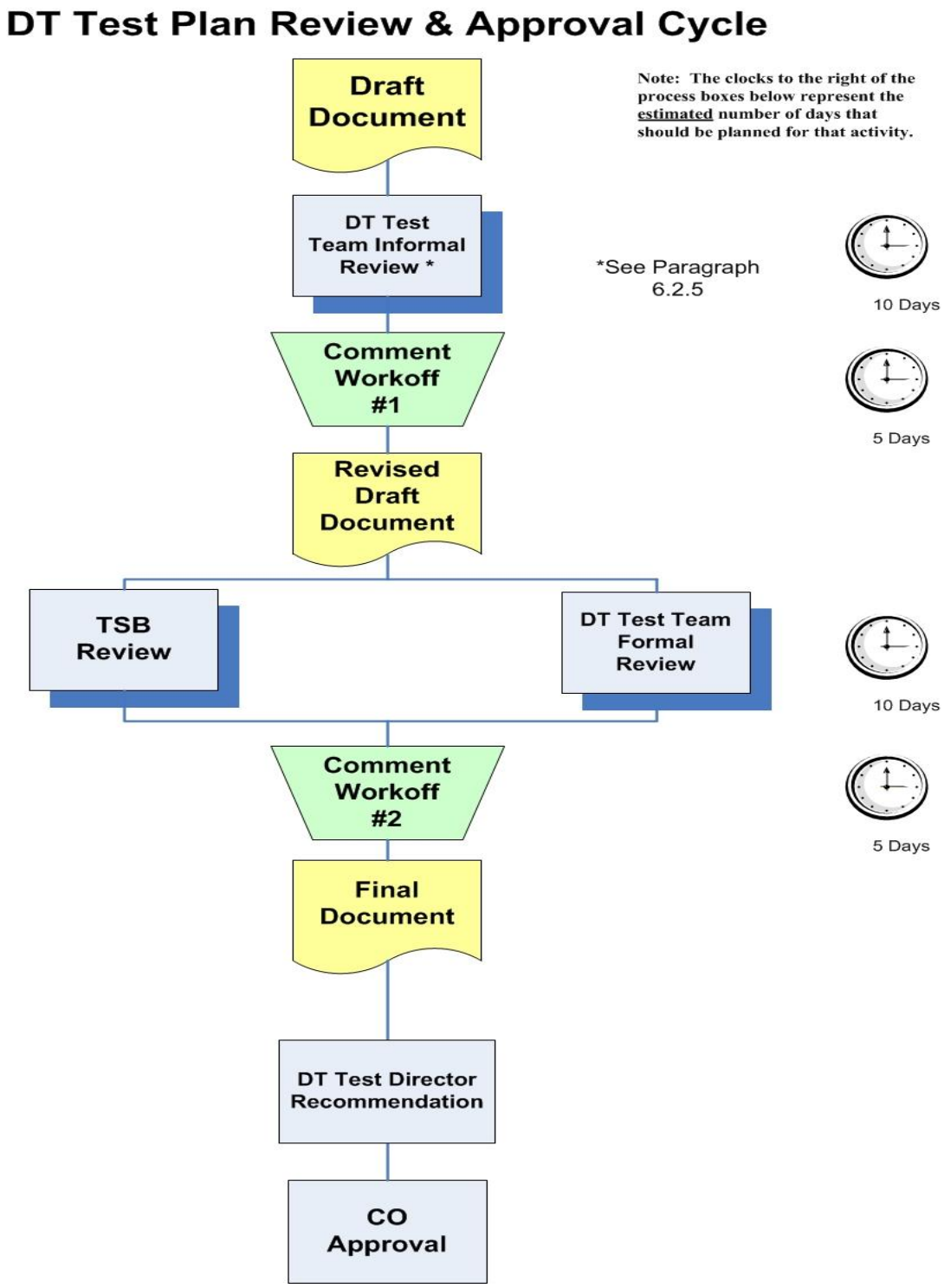

FIGURE D-5. DT TEST PLAN REVIEW & APPROVAL CYCLE

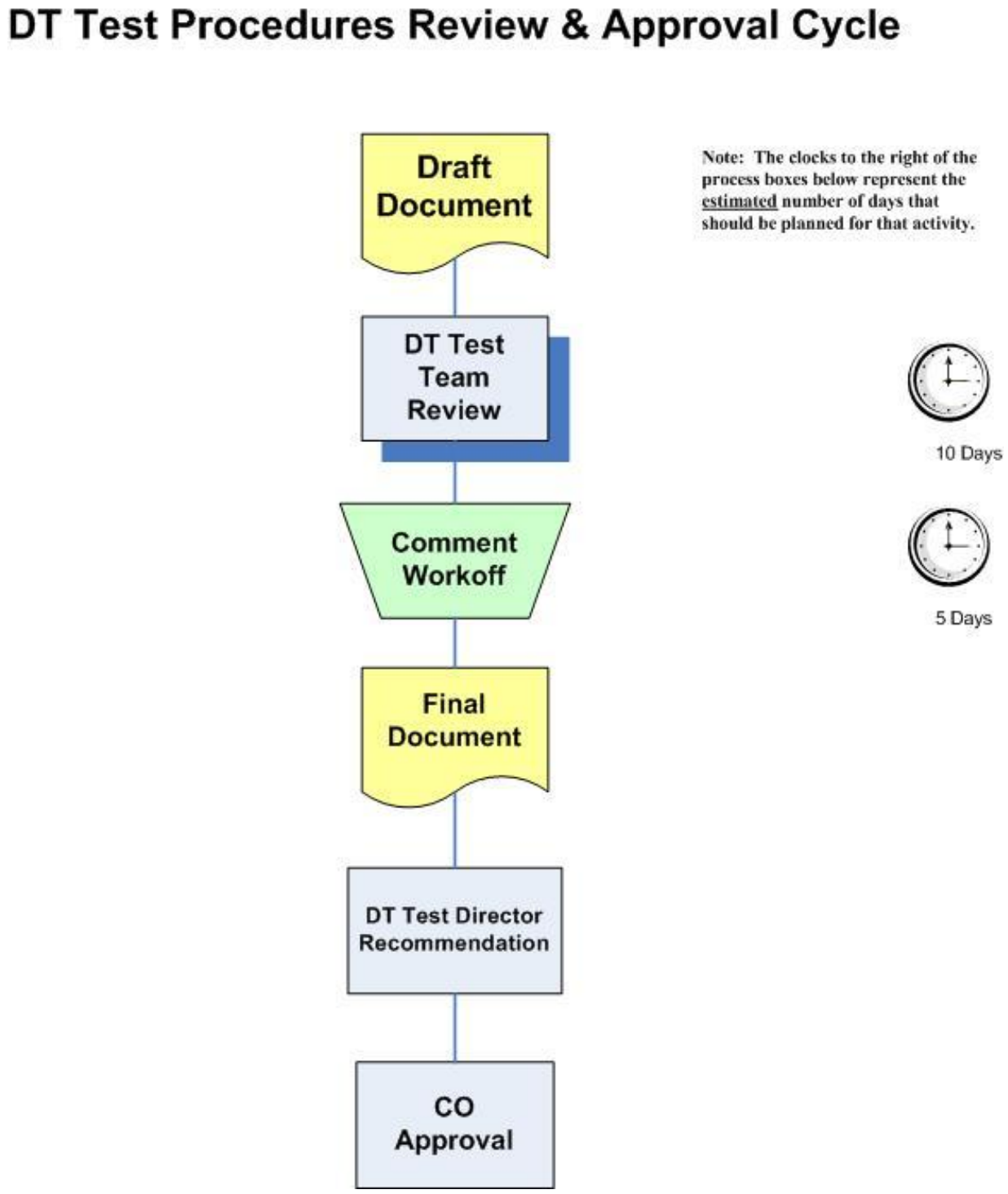

FIGURE D-6. DT TEST PROCEDURES REVIEW & APPROVAL CYCLE

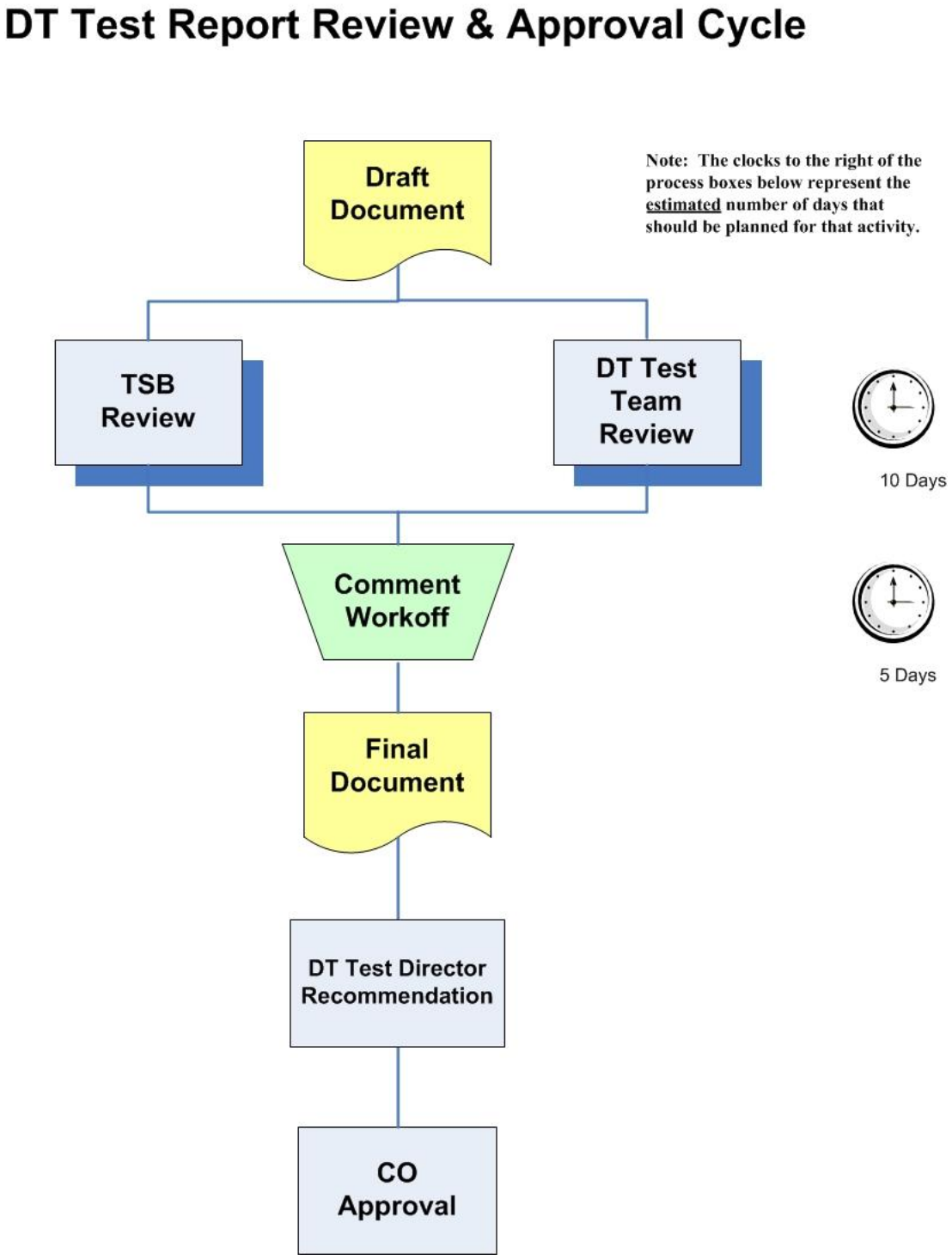

FIGURE D-7. DT TEST REPORT REVIEW & APPROVAL CYCLE

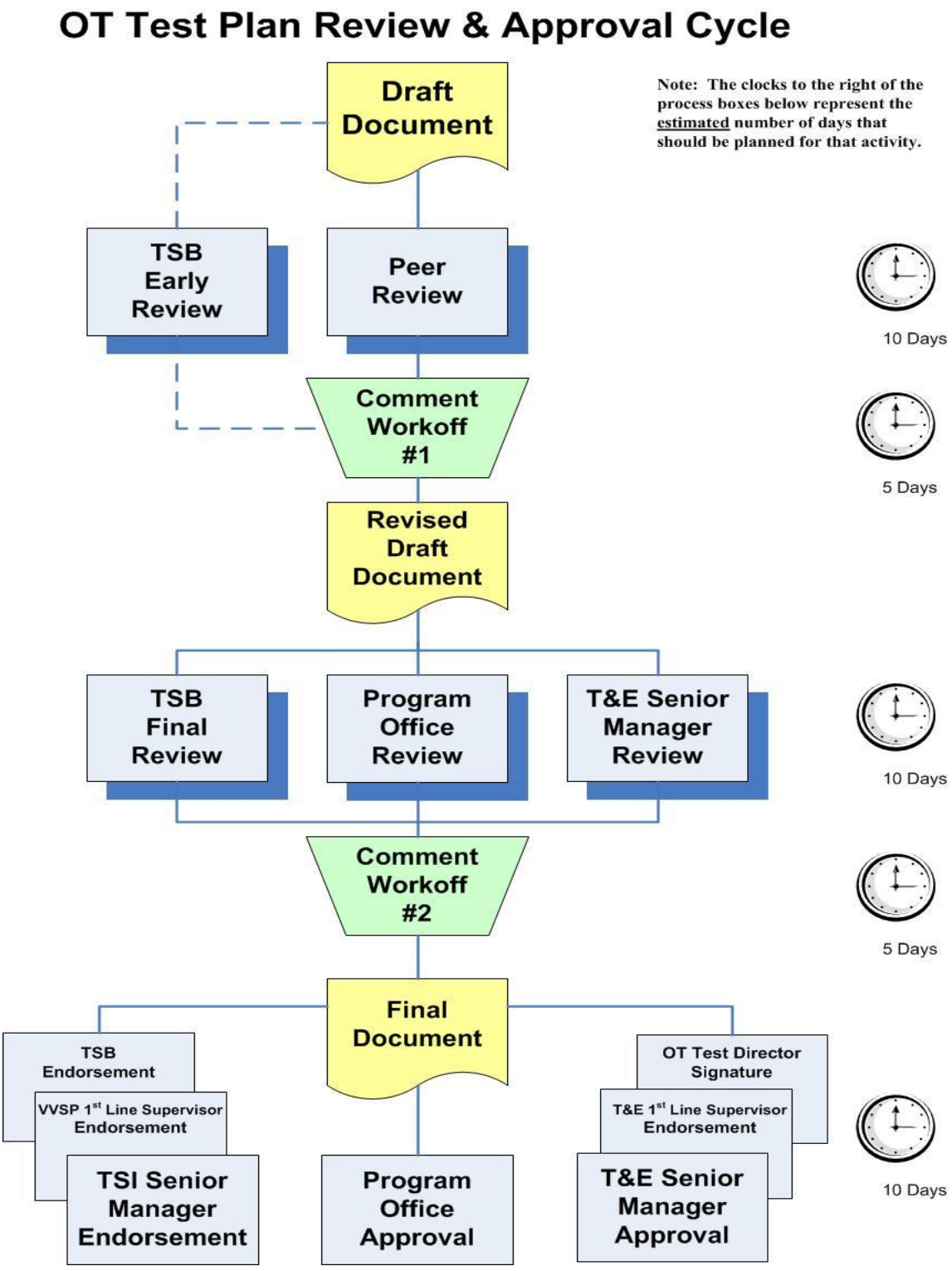

FIGURE D-8. OT TEST PLAN REVIEW & APPROVAL CYCLE

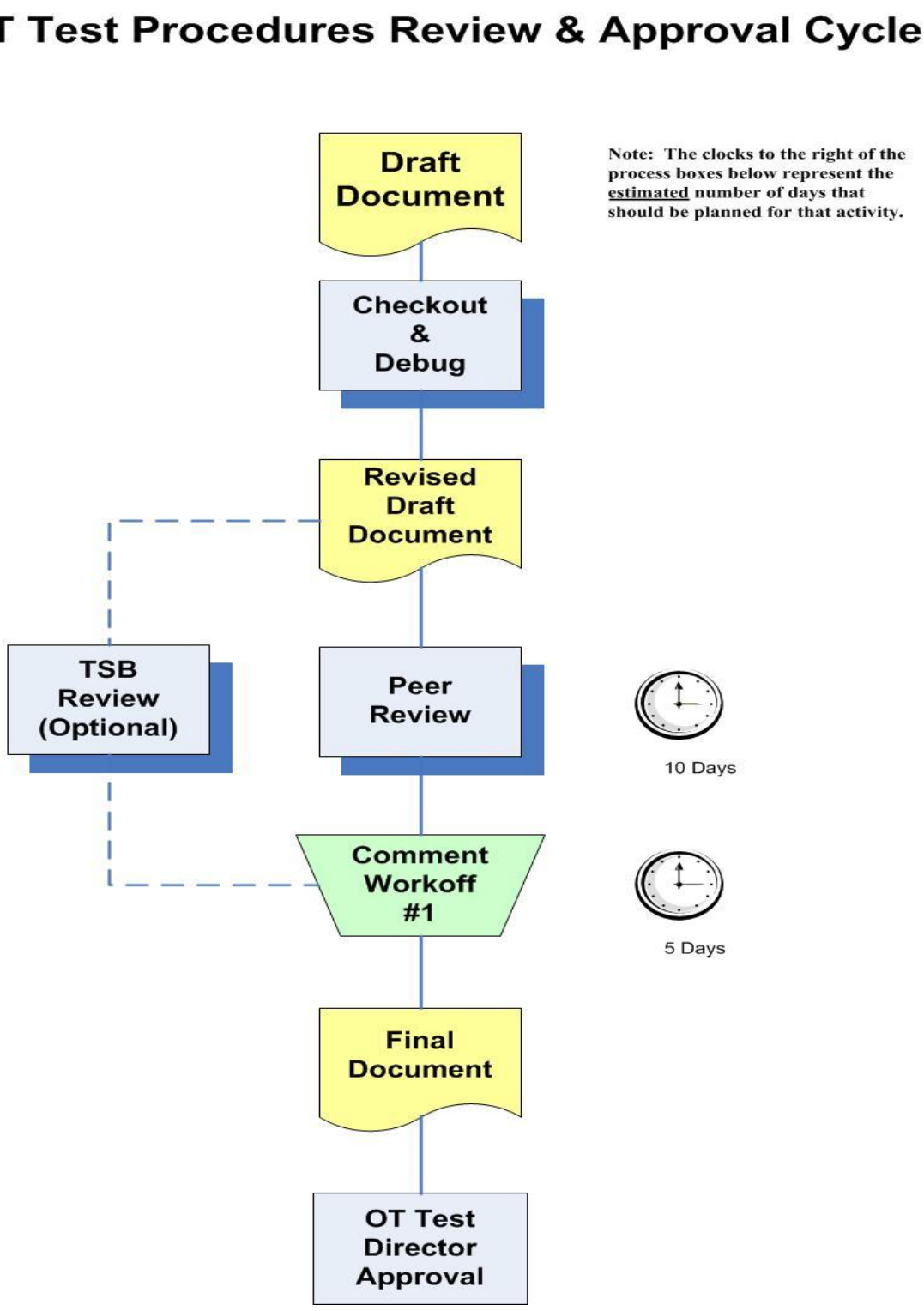

FIGURE D-9. OT TEST PROCEDURES REVIEW & APPROVAL CYCLE

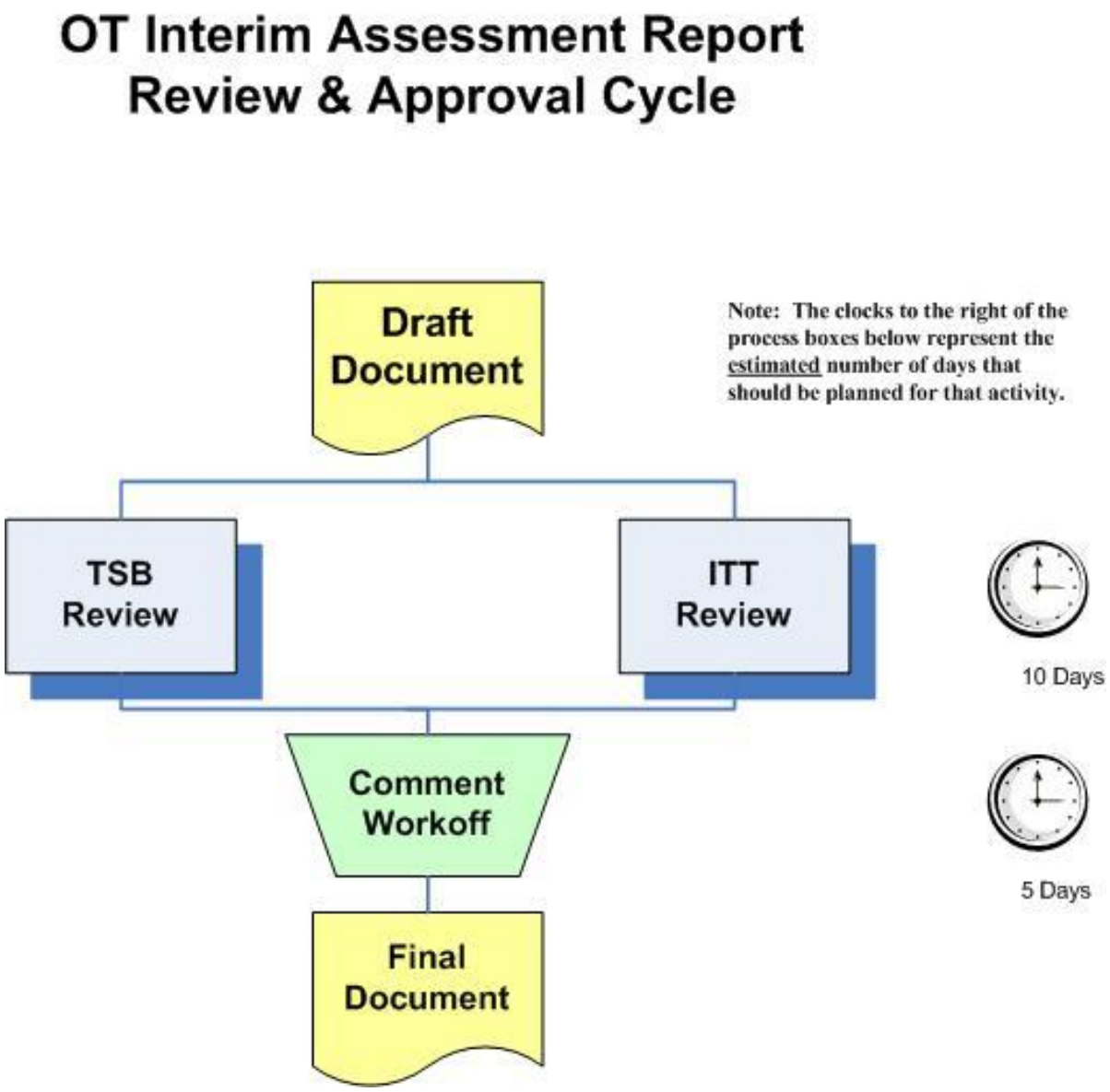

FIGURE D-10. OT INTERIM ASSESSMENT REPORT REVIEW & APPROVAL CYCLE

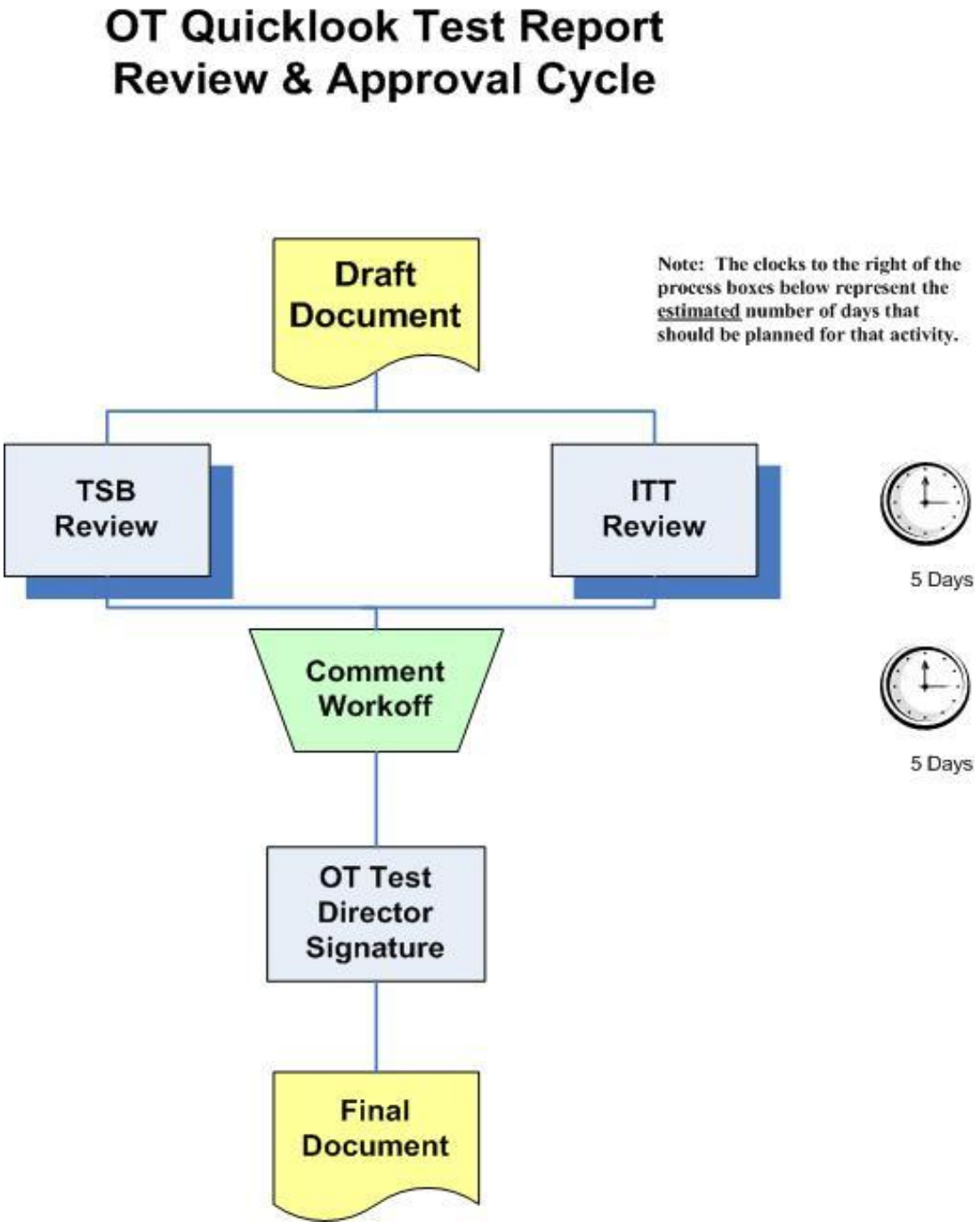

FIGURE D-11. OT QUICKLOOK TEST REPORT REVIEW & APPROVAL CYCLE

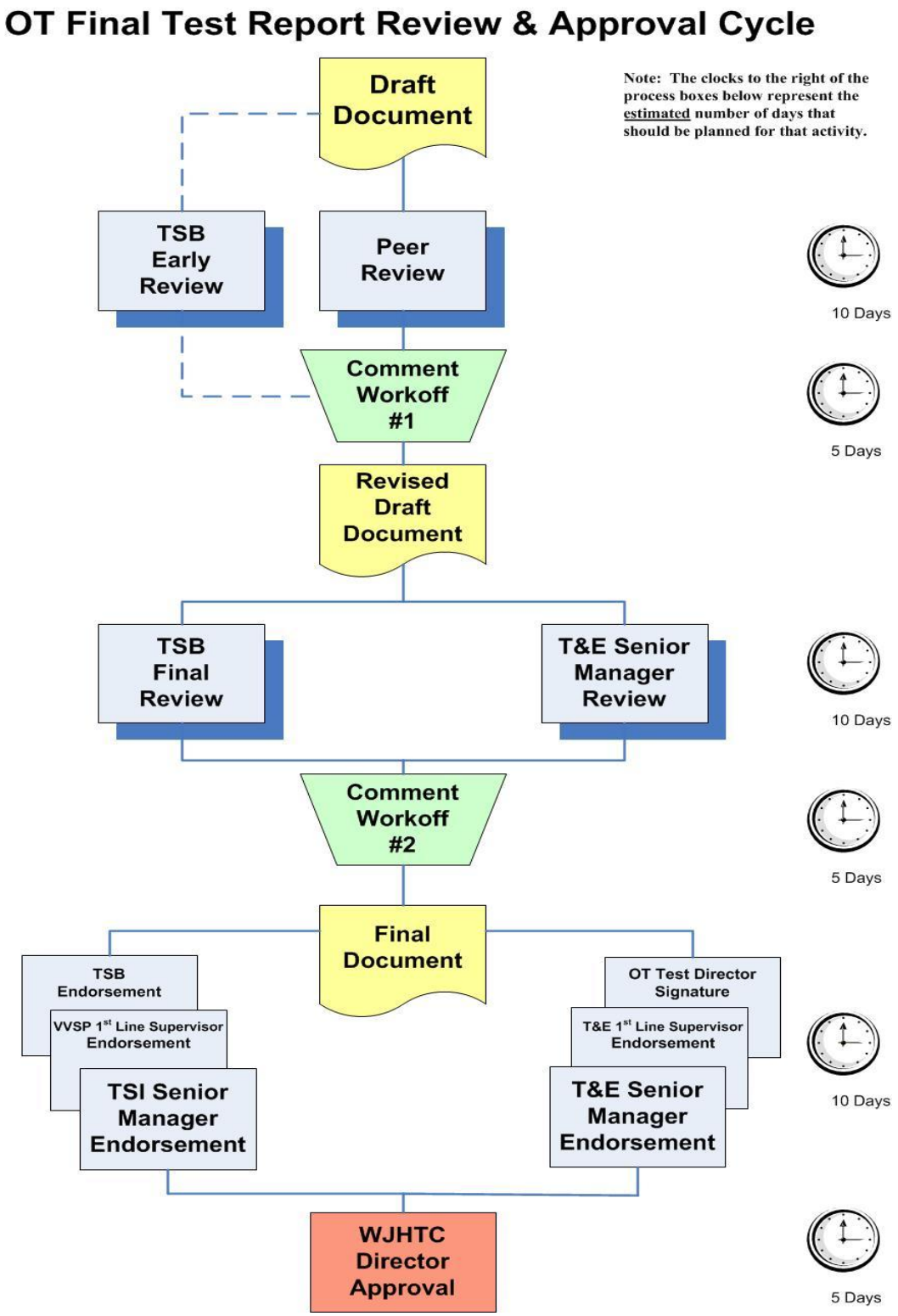

FIGURE D-12. OT FINAL TEST REPORT REVIEW & APPROVAL CYCLE

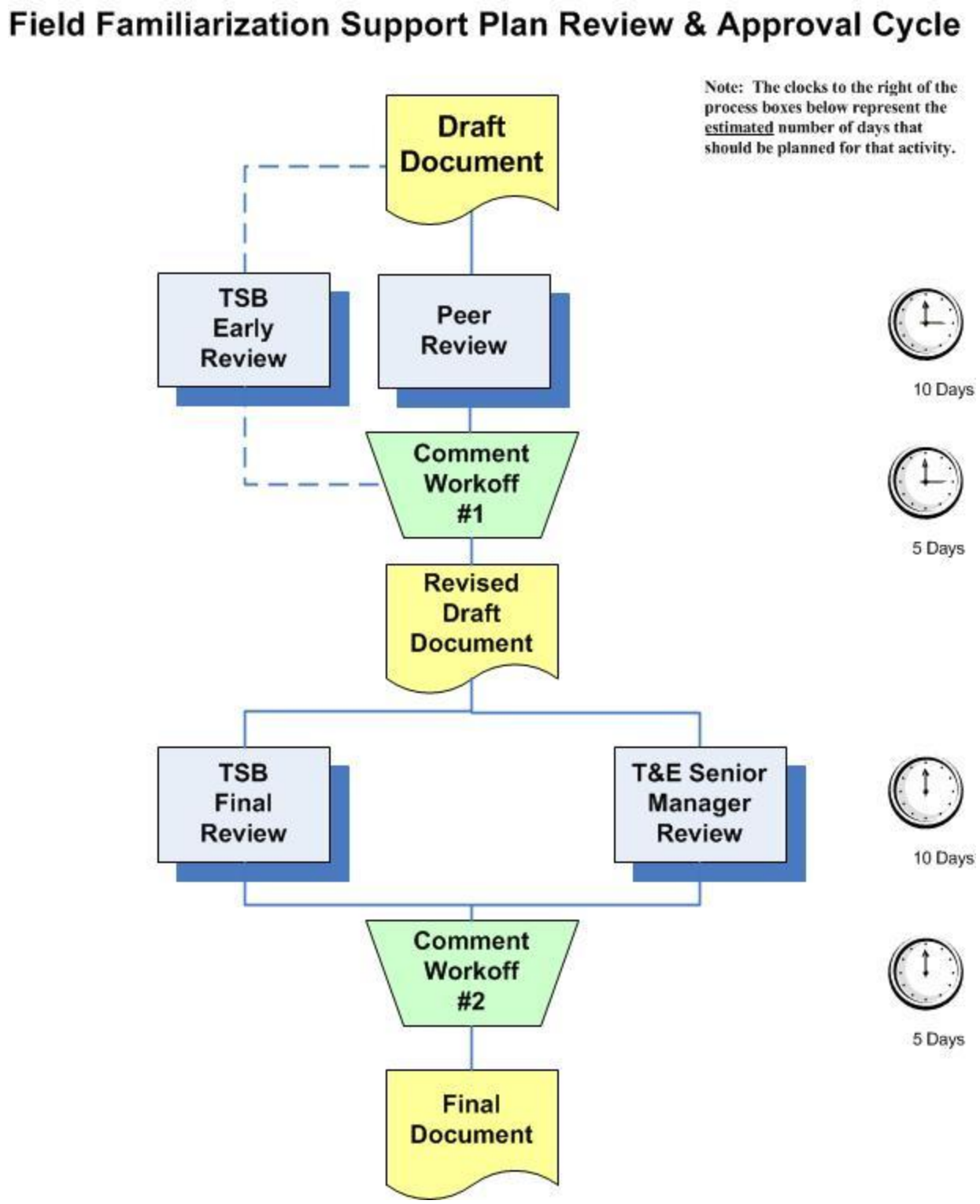

FIGURE D-13. FIELD FAMILIARIZATION SUPPORT PLAN REVIEW & APPROVAL CYCLE

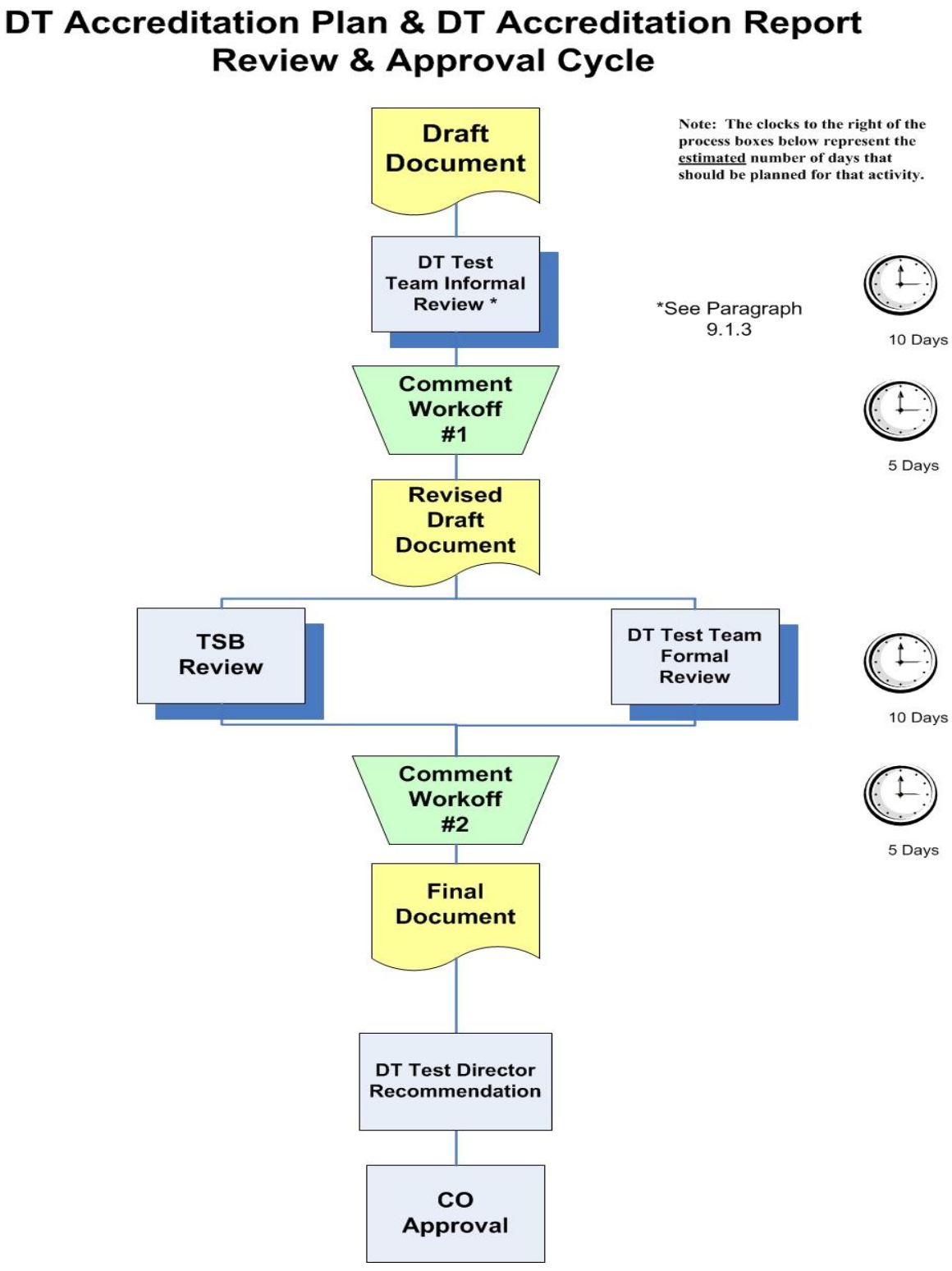

FIGURE D-14. DT ACCREDITATION PLAN/REPORT REVIEW & APPROVAL CYCLE

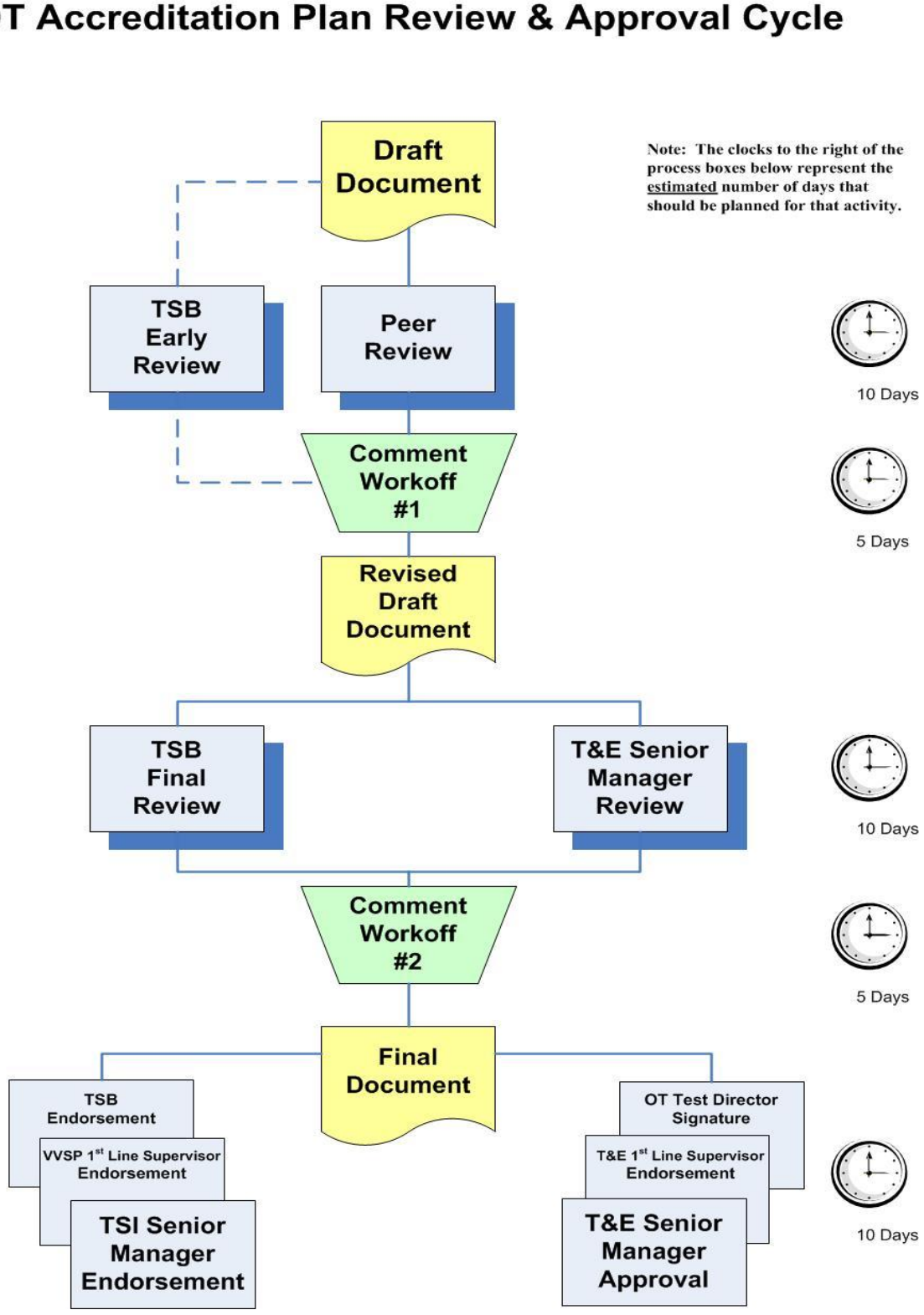

FIGURE D-15. OT ACCREDITATION PLAN REVIEW & APPROVAL CYCLE